THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

NUMBER XXVI. SECOND SERIES. July 1, 1804.

Specification of the Patent granted to WILLIAM FREEMANTLE, *late of Bunhill-row, in the Parish of St. Luke, Old-street, but now of Hoxton, in the County of Middlesex, Watch-maker; for Improvements in the Construction of Steam-Engines.* Dated November 17, 1803.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Freemantle do declare that the nature of my improvements in the construction of steam-engines is herein particularly described; that is to say: My first improvement consists in making the steam-cylinder or cylinders, when more than one is made use of, so that the diameter of the bore shall be about equal to the length of the stroke, by which means the friction will be much reduced; for since the force of an engine is proportional to the contents or capacity of the cylinder, which is as the square of the diameter multiplied into the length,

length, but the friction is proportional to the diameter multiplied into the length; therefore it follows, that in two cylinders of the same length, but of different diameters, the friction will be less in the larger diameter in proportion to its force than in that of the smaller diameter, and it is equally obvious that in two cylinders of the same capacity, but of different lengths, the friction will be least in the shortest cylinder, for the friction increases only as the diameter, while the capacity (that is the force) increases as the square of the diameter; and in a cylinder of this form, the steam having less surface during its action, will suffer less condensation from without, and such a cylinder will be less expensive than one of the common form.

Fig. 1, (Plate IV.) represents a section of my cylinder, which is furnished with four pipes or channels, which may be either cast solid with the cylinder or be screwed or bolted on in any of the usual methods, the channel or pipe M N leads from M into the cylinder at N, O leads straight through into the bottom of the cylinder E, D communicates with the boiler, and F G with the condenser. Each of those four channels terminates in the face of the part P Q R S, which must be made exceedingly flat. The figure of those terminations are represented by Fig. 2. My universal circular valve is shown at Fig. 3, where A B C D E F G H represent two excavations, nearly as deep as they are wide, each occupying three-eighths of the whole circle, so as to leave the two solid parts A C E F and D B G H each one-eighth of the circle from A. There is a narrow circular channel about one-fourth of an inch deep, inclosing or surrounding the excavation E F G H, and entering A B C D again at B. The face of this valve must be made flat, as it applies to the part P Q R S, Fig. 1. Now when the engine is at rest,

rest, and all the passages shut, the centre of the excavation A B C D will lay over the hole or passage E, Figs. 1 and 2, and the centre of E F G H, Fig. 3. over the centre of F, Figs. 1 and 2. As C D, Fig. 1, communicates with the boiler, it will be filled with the steam, and consequently A B C D, Fig. 3, and the channel which surrounds E F G H; so that as long as the elastic force of the steam exceeds the pressure of the atmosphere, no air can possibly enter E F G H, even though the valve should not exactly apply to every part of P Q R S, Fig. 1. The engine when at work, by means of a crank or other contrivances, causes the valve to vibrate on its axis one-eighth of a circle, or forty-five degrees each way, from the situation before described; and it is obvious that steam will be alternately admitted through the passages M and O into the top and bottom of the cylinder; and that when steam is admitted into the top of the cylinder, the bottom communicates with the condenser, and that when the valve is turned so that steam is admitted to the bottom of the cylinder, the top communicates with the condenser. Now by turning the valve into such a situation, that the centre of the excavations are over the centres of M and O, Figs. 1 and 2, the holes E and F, Figs. 1 and 2 being wider than the solid parts of the valve A C E F and D B G H, the steam is at liberty to pass through the uncovered parts of E into both the excavations in the valve, and through the holes M and O into the top and bottom of the cylinder, and also into the condenser through the uncovered parts of the hole F; by which means the engine may be blown of air previous to its being set to work.

When the single power engine is used, that is when the steam is made only to act against the bottom of the piston, and the top of the cylinders left open, the chan-

 nel

nel M N, Fig. 1, and the hole M, Fig. 2, will be omitted by making use of two steam-cylinders instead of one. The force of the engine may be rendered so nearly equal in every part of its revolution as to act with a much smaller fly than is commonly made use of, the piston of those cylinders being made to act on two arms of one crank, placed at right angles to each other. In this case the valve, &c. must be constructed as follows: the part, Fig. 5, has six holes, and communicates with the boiler, condenser, and the top and bottom of both cylinders, and may be placed in any convenient situation between the cylinders. For distinction we will call one of the cylinders No. 1, and the other No. 2. The communications are as follows: the hole F communicates with the boiler, the hole E with the condenser, A with the top of the cylinder No. 1, B with the top of No. 2, C with the bottom of No. 1, and the hole D communicates with the bottom of No. 2. Fig. 5 represents the valve with its two excavations A B C D and E F G H, as in valve Fig. 3, the excavation A B C D communicates with the groove K L M, part of which groove always lies over the steam hole F, Fig. 4; therefore let the valve be in what situation it may, A B C D will always be filled with steam. In like manner the excavation E F G H communicates with I, which always laying over the hole E, Fig. 4, it follows that E F G H in every part of its rotation will have communication with the condenser. This valve is not to vibrate like the other, but to revolve on its axis, making one turn to each stroke of the engine, it is very easy to conceive how the communications successively take place so as to produce the desired effect. If this valve be shifted half a revolution, with respect to the crank, the communications will take place in such order as to cause the engine to turn the contrary way.

An

An engine constructed in this way is capable of its motion in any part of the revolution.

I must remark here, that the steam-passage F, Fig. 4, may be placed in any part of the circle most convenient, so that it corresponds with the groove K L M, Fig. 5. When two open-top cylinders are used, the two passages A and B, Fig. 4, are to be omitted.

I next proceed to describe the principle on which my parallel motion depends, and the method of constructing it, in order to which it will be necessary to demonstrate the following proposition, *viz.* that if one end of an inflexible bar be compelled to move in a right line, and the middle point to describe the arch of a circle, whose centre is in that line, and whose radius is equal to half the length of the bar; the other end of the bar will describe a right line at right angles to the first line. Let A B, Fig. 6, be the bar, D B the right line, in which the end B of the bar is compelled to move, D the centre of the circle, in which the middle point C of the bar is compelled to move, and D C the radius of the circle equal to A C, equal to C B. I say the point A will describe a right line at right angles to B D, which is thus demonstrated; since A C equal D C, the angle C A D equal to angle C D A, and as D C equal C B, the angle D B C, equal the angle B D C, therefore the angle C A D added to the angle C B D equal the whole angle A D B, consequently A D B is a right angle, and the locus of the point A a right line, which was to be demonstrated. I apply this to the purpose of producing parallel motion in the following manner. B A, Fig. 7, is a bar or beam, either of wrought or cast-iron; the end B of which is forked, as may be seen in Fig. 8, and is furnished with a friction-wheel, which fits a notch in the piece F, which piece is fixed to a convenient part of the frame

frame of the engine; the sides of this notch must be parallel to each other, and perpendicular to the axis of the cylinder. The friction-wheel must have two small franges, to prevent it from slipping out of the notch sidewise, as in Fig. 8. There is another piece D G which turns on D by means of brasses fixed to the frame of the engine. This piece is connected to the bar B A at C, so that B A may turn about C as a centre. Those two pieces may be connected by a pin, or otherwise, as may be most convenient. The piston-rod A E is connected to the bar B A by means of a joint at A. The centre of the friction-wheel at B, the centre of the joint at A B, the centre of the axis D, on which the piece C D G turns, must be all equally distant from the centre C. Where the two pieces are connected, those conditions being observed, it will follow, from what has been demonstrated, that the point A will describe a right line, and of consequence the piston-rod connected with it must move parallel. Rotary motion is to be produced by connecting the end A to the crank by means of a connecting rod in any of the usual methods.

Fig. 8 is an horizontal view of the parallel motion, the same letters referring to the same parts as in Fig. 7. The piece C D G may be made double or forked, as in Fig. 8, or it may be made single, that is, it may be cut off at the dotted line *x y*; in which case there must be a bearing at K. The part L G is intended to work the air-pump. The cold and hot water pumps may be wrought from any part of the parallel motion, as may be most convenient, or a lever may project from any part of C D G, to effect either of those purposes.

Fig. 9 is a section of my condenser, which, instead of being of the usual form, *viz.* a cylinder, is in the form of a parallelopiped at H, in a pipe large enough to admit

mit the end of the pipe F G, Fig. 1. Q is the jet-pipe, which enters the condenser in the centre, and projects a small way down into it. The end *x y*, which is ground to fit the flat end of the pipe, is capable of being elevated or depressed by means of a screw, or otherwise, so that the cold water will flow out all round the pipe in a thin sheet, the thickness of which may be regulated at pleasure by the screw. I apply the cold water to the outside of my condenser in such a way as to cause a much greater number of its particles to come in contact with the external surface of the condenser than in any method yet practised. This is effected by making the bottom of the cistern to come within a small distance of the condenser, as in the figure where A B C D E F G is a section of the cistern. The cold water enters at K, and following the direction of the darts, runs first under the condenser, and filling the space E F G B passes under L and M, and over the whole length of the side of the cistern at I, which is made lowest on that account. The pieces L and M which go across the cistern are to compel the current to run close to the upper surface of the condenser. The cistern may be made square as A N G D, and a partition may be put in place of D E, which will answer the same purpose of making it of the figure A B C D E F G. The space E F G B is intended to receive the air-pump, which I make on the principle of De La Hire, to exhaust both by the ascent and descent of the piston, and is connected to the condenser by two pipes, proceeding from the side O, one leading to the top and the other to the bottom of the air-pump, which is fixed to the side B G of the cistern, and discharges the hot-water, air, &c. through that side into a small cistern, fixed to the outside of B G.

I have

I have simplified the double air-pump, as follows. Fig. 10 represents a double air-pump with two valves only. A B C D is the barrel or cylinder, which in length exceeds the length of the stroke by the length of the piston. Exactly in the middle of the barrel is a grating I K, communicating by means of a pipe with the condenser. E F G H is the piston, which must be of such a length E H, as with the breadth of the grating I K to be equal to the length of the stroke; so that the piston at its greatest altitude and depression shall leave the grating uncovered. At the top and bottom of the barrel are two valves, opening outwards, which are all that are required, the piston performing the office of the other two.

Fig. 11 will explain my improvement in the cold water pump, which will obviate the inconveniences arising from the inner lid of the ascending column of water, and also prove of very considerable utility when the pipes leading to the pump-barrel are too small, or when the motion of the piston in the barrel is very quick. This improvement consists in placing an air vessel so as to communicate with the ascending column of water immediately below the lower valve of the pump, as in Fig. 11, where A B is the pump-barrel, C D the air vessel, A the piston, and B the lower valve; E is the pipe leading to the well. Now it is evident, that before water can be raised into the barrel A B, a partial vacuum will be made in the air vessel C D, and the rarity of the air in C D will be proportional to the height of C D above the surface of the water in the well, since the water can ascend in the barrel only with a determinate velocity, and which depends on the height of the piston above the surface of the water in the well, and also on the diameter of the pipe E. It may, and sometimes does happen, that the velocity

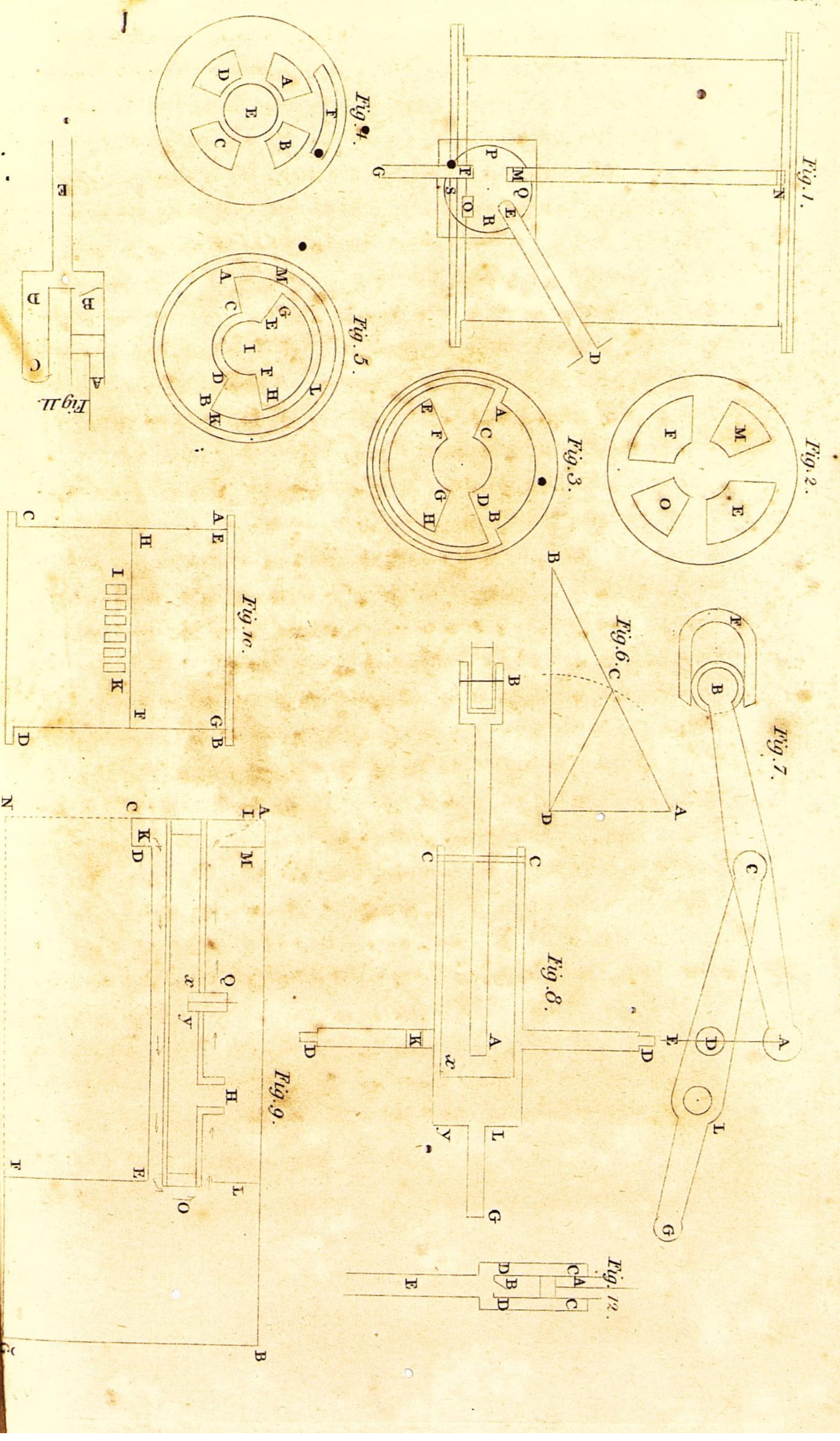


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.

Fig. 1.

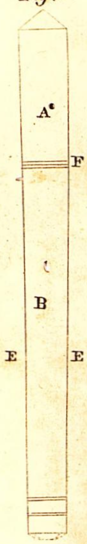


Fig. 2.

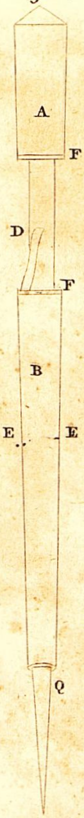


Fig. 3.

Fig. 4.

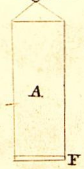


Fig. 6.

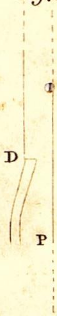


Fig. 5.

Fig. 10.

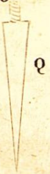


Fig. 8.

Fig. 11.

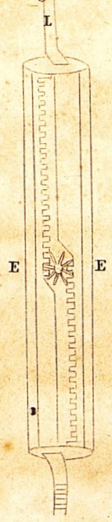


Fig. 12.

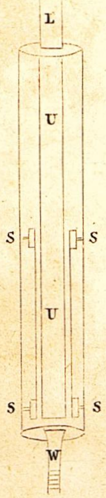


Fig. 7.

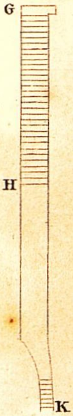
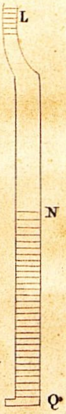


Fig. 9.



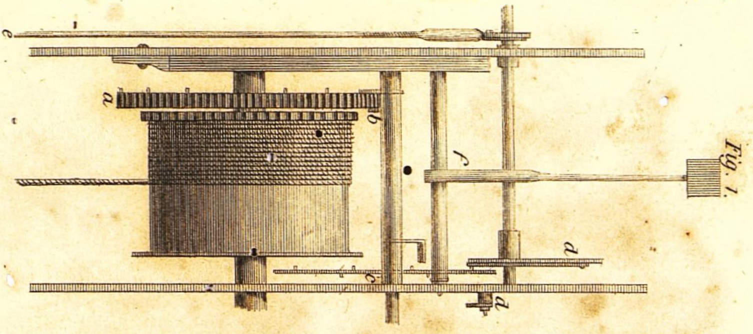


Fig. 1.

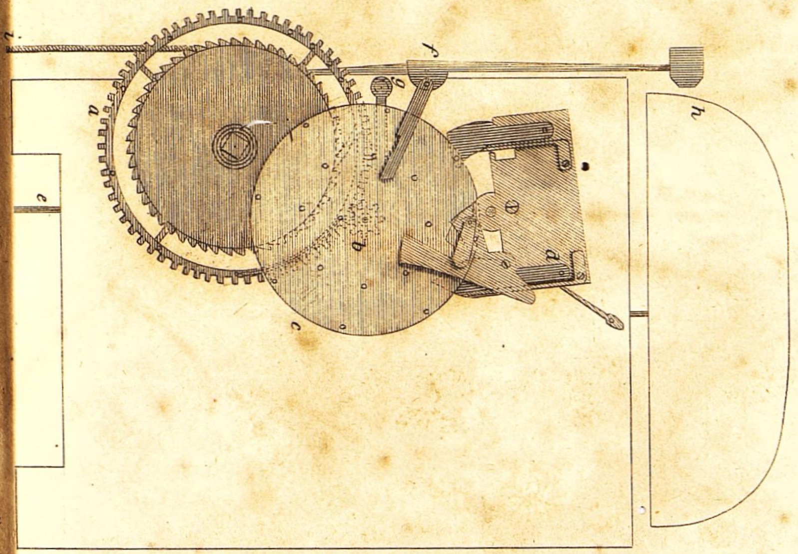


Fig. 2.

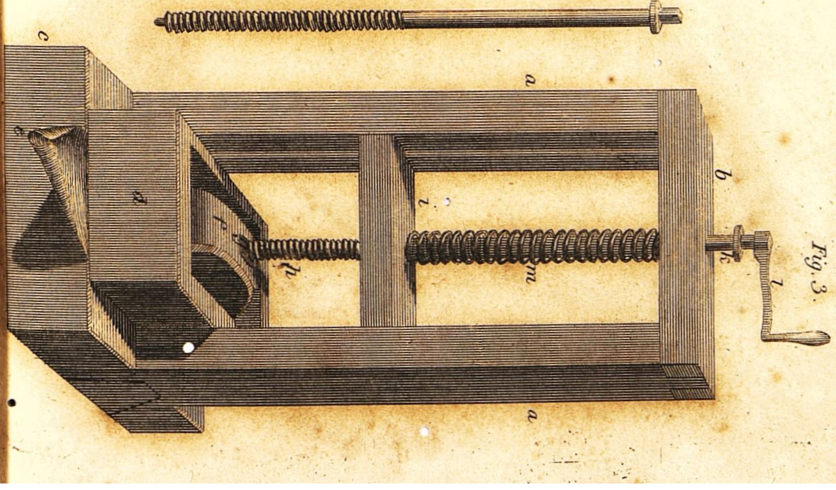


Fig. 3.

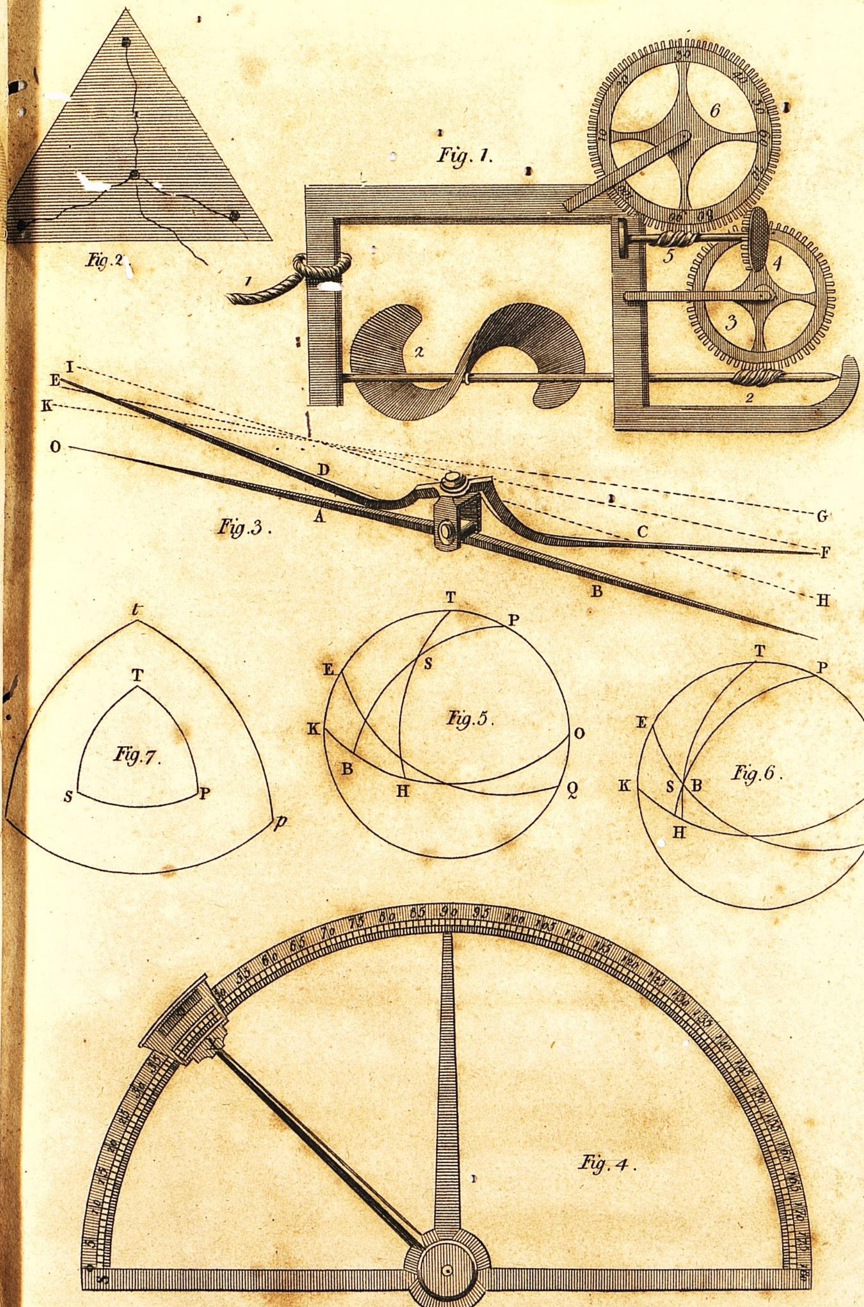


Fig. 1.
Fig. 2.
Fig. 3.
I
E
K
O
D
A
C
B
G
F
H
Fig. 7.
t
T
S
P
p
Fig. 5.
T
P
E
S
K
O
B
H
Q
Fig. 6.
T
P
E
K
S
B
O
H
Q
Fig. 4.

velocity of the piston exceeds that of the water, and a vacuum is formed between the bottom of the piston and the surface of the column of water. The effect of this is, that when the piston begins to descends it meets the ascending column of water, and a very violent concussion is produced, which is exceedingly detrimental and destructive to the pump and any apparatus connected with it, the air vessel will prevent those disagreeable effects taking place; for, instead of a vacuum being formed below the piston, air will be extracted from the air vessel; and as the piston descends, the pressure of air on the surface of the water in the well not being counter-balanced, will continue to rise into the vessel till the equilibrium is restored; and when the piston ascends again the barrel will not only be supplied by the pipe E, but also by the water in the air vessel, so that the piston must require less force to lift it than if there was no air vessel. The same effects will take place if the pipe E is too small. The air vessel may be made in a variety of forms; perhaps that represented by Fig. 12 may be as convenient as any, in which the air vessel surrounds the pump-barrel. The same letters refer to the same parts as in Fig. 11. This improvement may be applied either to the forcing or lifting pump.

In witness whereof, &c.

Mr. Freemantle desires us to state, that he has erected an engine, of a construction agreeably to the preceding specification, at Bedworth, near Coventry, of a twenty-horse power, which answers exceedingly well.

MAHARAJA SERFOGI'S SARASWATI MAHAL. THE TANJORE
N. Speci

Specification of the Patent granted to JOHN CANT, *late of the Town of Brechin, Tanner, and* JOHN MILLAR *of the Town of Montrose, Tanner and Leather Dealer, both in the County of Angus, North Britain; for a new Method of Tanning Leather, whereby a great saving will be obtained both in Expense and Time, and whereby a better Article is produced.* Dated May 11, 1802.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said John Cant and John Millar do hereby declare that our said invention of a new method of tanning leather is described in the manner following: that our method of preparing hides and skins by liming, hairing, fleshing, and baiting, is the same as that in use by the most experienced tanners; that is to say: All leather that is to be dressed or curried, we use the operation of what tanners call baiting, for this reason; that the leather when curried should carry a sufficient quantity of oil, and dry a good colour. But the hides which we put forward for crop instead of baiting them (as done by many), we work them out among fresh water, and put them immediately to the tanning process, for this reason; that it preserves both the substance and quality, and turns out in tanned leather an article of more weight and solidity than if baited. Those hides intended for butts and backs we raise as usual, but prefer acids made of rye rather than vitriol. That our method of tanning, as invented by us, after preparing as above, is that we erect a boiler of copper, or any other metal that does not stain the tan or liquor, in which we put a quantity of bark, ground sufficiently small so as to fill the vessel about half full; then

then fill it up with water or liquors that has been already used, and the strength of tan mostly exhausted to within about six inches of the top; then make it to boil by a brisk fire, which, if the boiler is properly placed for that purpose, may be done in an hour, and let it boil from two to three hours, by which time the tanning principle is completely extracted from the bark or other substances made use of; after which we let it run off by a cock, at the bottom of the boiler, into the pits or handlers, where it stands till it is completely cold. After all the liquor is run off from the boiler, we fill it immediately with spent liquor or water, and then drag out the old tan or spent bark, &c. and put it into a lake, and run water or exhausted liquor upon it as soon as possible, from which we supply the boiler until we have every particle of substance from the bark that may be remaining. Then we put the hides or skins in said liquors thus prepared, and handle them frequently, by taking them out and putting them in again, particularly the first day or two, as the liquor is too powerful for them to remain long at a time in the first stages of the process. Then we remove the different lots of goods to fresh liquors from time to time, as the old is weakened, until they are completely tanned. By this method we collect a greater quantity of the tanning principle into a small compass from bark and other substances, and consume far less bark, or quantity of other tanning substances, than is done by any other process whatever hitherto practised, besides a very great saving of labour and wages.

We proceed as follows with the different species of leather, with hides and skins for dressing or currying, after being baited. We wash them in clean water, unless we have a stock of weak liquors to put them in, first; then we put them into a liquor that has been already

used, and bring them forward to stronger and stronger until tanned; and when we wish to produce leather with a whiter colour or bloom, we put a small quantity of the dust or smallest of the bark amongst the liquor. By this method we tan hides that have been shaved in the baits in fourteen to twenty days, and skins in eight to twelve days, according to their substance, and produce them better tanned than by the old or usual process, that takes in general nine months to the one, and six months to the other. Hides for crop after prepared as before mentioned, and washed through clean water, we put into our strongest liquors prepared from water only, and the harder the better, and handle them up and down five or six times the first day, and the second day put them to a new liquor, and handle them three or four times, and so on, changing them in different liquors, according to the strength thereof and quantity of hides together. By so doing, and by properly attending to them, they are tanned, although very heavy hides, in five or six weeks instead of ten or twelve months, the usual period necessary by the old process. Hides for butts and backs after raised as before mentioned, we prepare liquor with hard water, and then suspend them among liquors so prepared upon rods or ropes placed across the mouth of the pit, as near the top as the liquor may cover the hides, and at such distances as may not touch each other, and lift or raise them out among the liquors two or three times the first day, and once or twice the second, and then put them to a new liquor; and as often as we find the liquors weakened, and the shorter time they are exposed to the air the better, as it injures the substance or thickness forced by the acids. After being so managed for a month, when we wish them to have a whiter colour or bloom, we lap them away among liquor, as before prepared,

pared, with a layer of dry bark twixt each, which gives them the bloom wanted. Where hard water cannot be [illegible] lap the hides among water as usual, with layers of [illegible] each, which if small ground will be exhausted [illegible]ks, then to be lapt away among strong liquor, [illegible] pared by us, and a layer of dry bark: this takes fo[illegible]ks, and then another lap in same manner, which take[illegible]six weeks, when they are sufficiently tanned, unle[illegible] the hides are very weighty, and it may be judged nec[illegible]ssary to give them another. But we prefer the first me[illegible]hod, as more expeditious; but either is sufficiently sho[illegible] compared with the old process, which requires as many months as we do weeks.

A very great advantage is derived by our method of extracting the tanning principle from bark, &c. by boiling, as business to any extent may be conducted or carried on upon about one tenth part of the capital employed on the old plan. Hence a great national as well as individual advantage, besides a very considerable saving by substitutes for oak bark, which could not be done by any other method. We have tried a quantity of oak chips, which produced a strong tanning principle; as also oak saw-dust. We have likewise tried the common heath or heather, and have actually tanned leather with each of these separately by themselves. The bark of most kind of trees that produce hard wood has a tanning principle in them, and by our method can be easily extracted and ascertained; but, above all, we recommend the young growths or shoots from the roots of oak trees, and of such superfluous twigs or branches that can be lopt off so as not to injure trees, of which a great quantity can be got annually in the kingdom. These when cut in the proper season may be chopped in such lengths as

as is usual with bark; and when ground and boiled all together will produce a stronger tanning liquor than very old bark from the trunks of trees that have a thick str[illegible] crust or rhind upon them, and which cannot [illegible] from the bark. These and the different s[illegible] before mentioned that can be made use of b[illegible] operation we presume will tend greatly to lesse[illegible] value or price of bark, which is the most expe[illegible]ticle in the manufacture of leather. Farther, in ord[illegible] to ascertain whether bark-liquor, as prepared by us would have a more powerful effect when fermented, we have made trial of it in that way, and find that it answers much the same purpose with our boiled liquors. We have also gone so far as to try it by distillation, but do not find that it improves our process.

Specification of the Patent granted to EDWARD THOMASON, *of Birmingham, in the County of Warwick, Manufacturer; for an improved Mode of making Pikes.*

Dated February 7, 1804.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with, and agreeable to, the true intent and meaning of the said proviso, in the said letters patent contained, I the said Edward Thomason do hereby declare that the following is a particular description of the nature of my said invention, and methods and improvements in the mechanism of pikes, both in respect to principle and the way and means in which the same may be performed; that is to say: With respect

spe[illegible]t to principle, I cause the pike part or sword-blade [illegible]rt to be ejected or forced out at one end of the [illegible] staff, or stail, by the action of pulling towards you, [illegible] from you, the handle part at the other end [illegible]g to the said tube, staff, or stail; and I cause th[illegible]e part or sword-blade part to be hid or forced up [illegible]n the said tube, staff, or stail, by the action of push[illegible]g from you or pulling towards you the aforesaid handle or working part, connected with, or belonging to the said tube, staff, or stail, and this invention I call the *Flagrante Bello Pike*; and I claim the privilege of making these pikes of any length, as circumstances may suit or occasions may require.

Now I do declare the above-mentioned principle comprehends the real object of my invention; and in order for the better comprehension and understanding how the aforesaid may be reduced to practical use, I do hereby farther declare, that although I vary the mode of construction by a variation of circumstances to produce the said effects, and obtain the main purpose intended; yet I principally adhere to the methods herein described as being fully answerable to what is required, and best calculated to be understood from the drawings and descriptions thereof; and the same is described in the three drawings and nine sections represented in the margin of these presents.

Fig. 1, (Plate V.) represents the pike in a quiescent state; the pike part or sword-blade part being within the tube, staff, or stail, (of section Fig. 5,) B.

Fig. 2, represents the pike ready for use as a weapon; the pike part or sword-blade part having been ejected or forced out at the end of the tube, staff, or stail B, by the movement of the handle A.

Fig.

Figs. 4 and 5, represent the outward tubes, staffs, or stails A and B; which two tubes, staffs, or stails, pear at a short distance when the pike is shut tube, staff, or stail, being connected toget Fig. 6.

Fig. 3, is a connecting rod or tube f d at one end to the handle sect. Fig. 1, and th other end is fastened or attached to the end of the ra part at L, or sect. Fig. 9. On or in this connecting r d or tube, sect. Fig. 6, is a string or stop as at D, which is to prevent the tubes, staffs, or stails, sect. Figs. 4 an 5, closing together at F F when the pike is in actual use as a weapon, but by forcing down the spring D the two tubes, staffs, or stails A and B, may be closed or pushed together, as appears in drawing Fig. 1, as at F.

Sect. Figs. 7, 8, and 9, are two racks and cog-wheel, all of which work or move together within the tube sect. Fig. 5, unexposed to the eye, but works as represented in sect. Fig. 11; that is to say, the cog-wheel, sect. Fig. 8, is fixed by a pin in the tube sect. Fig. 5, and moves on two centres, as at E E, in sect. Fig. 5. Sect. Fig. 7, is a rack to which the pike part or sword-blade part Fig. 10 is attached as at K, and moves from G to H on the cog-wheel sect. Fig. 8. Sect. Fig. 9, is the other rack, and which moves from N to O on the cog-wheel sect. Fig. 8, and the end L is fastened to one end of the connecting rod sect. Fig. 6, as at P. It is evident then, that when the cog-wheel is fixed in the tube sect. Fig. 5, and the two racks properly placed, as in sect. Fig. 11, that by pulling the end of the rack L it will give action to the cog-wheel sect. Fig. 8, which cog-wheel in moving gives action to the other rack sect. Fig. 7; and if the racks and cog-wheels are truly made, the rack, Fig. 7, will recede from

from you just as much as the other rack, sect. Fig. 9, will move towards you. It is by these means that the pike becomes elongated at both ends, and the pike part or sword-blade part, sect. Fig. 10, forced out of the tube, staff, or stail, Fig. 2, in the most convenient manner for use.

Sect. Fig. 12, is another manner of making the internal movements to obtain the same motion, and answer the same end; that is to say, instead of racks and cog-wheels, as in sect. Fig. 11, I use two, or a greater or less number of rollers or drums, which move upon their centres at S S S S. I use a band of leather, or any convenient substance that will answer the purpose, to put round these rollers, drums, or pulleys; which band I attach or fasten at its two ends as tight as convenient. The leg or shaft L U V is fastened to one side of the band, and the leg or shaft W is fastened to the other side of the band. The leg or shaft L U V then becomes the acting leg, or that which is joined to the connecting rod or sect. Fig. 6, and the leg or shaft W is attached to the pike part or sword part sect. Fig. 10. It appears evident then, that if the leg L is pulled the band will move round upon rollers in a space nearly as great as the distance from one roller to another, consequently the leg L will have moved with the handle A the like space, and the leg W on the contrary, will recede and push out the pike part or sword-blade part at the contrary end, as shewn in drawing Fig. 2 as at Q.

Drawing Fig. 3, exemplifies another mode of forcing the pike part or sword-blade part out of the end of the tube, staff, or stail; that is to say, F is in part a hollow tube, staff, or stail, with a groove cut a certain length on or in one side, as from G to G. H is another tube, which

slides upon the aforesaid tube, staff, or stail; a rib or tongue is fastened to the inner part of the tube H, and passes into the groove, where it is shouldered. At this shoulder, which becomes within the inner tube Z, is attached the leg end of the pike part or sword part, therefore by pulling the outer tube H up the groove G G the pike part or sword-blade part will be drawn up into the tube, staff, or stail Z; and by pushing the tube H back again the pike part or sword part will be drawn or forced out at the end of the tube Z, as exemplified in the drawing Fig. 3.

And I do hereby farther declare, that these pikes may be made of any length or width required. And also, that they may be made of any kind of metal, such as iron, steel, copper, brass, tin, or any other metal, or composition of metals, or any kind of wood, bone, ivory, paper, or any other substance, or composition of substances, that may be found sufficiently strong and proper for the purpose of manufacturing these pikes. And I also declare, that I ornament these pikes as circumstances require; which ornament I make of any kind of metal or metals, substance or substances, as may be judged fit for the purpose.

In witness whereof, &c.

Specification

Specification of the Patent granted to CATHCART DEMPSTER, *of St. Andrew's, North Britain, Gentleman; for certain Improvements in the Manufacture of Canvas, or strong Cloths, of Vegetable Materials, for Sails, Tents, Packages, and other useful Purposes.*

Dated August 30, 1803.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said Cathcart Dempster do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are described as followeth; that is to say: Instead of using single yarns not twisted, but glued together with starch, or other mucilage, in order to form the warp of the canvas, as is now commonly done, to the great injury of the article, by rendering it liable to spontaneous destruction by mildew, I use twine, composed of two or more yarns of prime material, of equal size and strength, both for the warp and woof. And I am by that means enabled to weave, and I do weave, my canvas without starch, or any other mucilage whatever, and do thereby produce an article nearly twice as strong as common canvas of the same weight and fineness, and with the advantage that its threads have an equal bearing on one another in all directions, not liable like the common canvas to split longitudinally, being much stronger in the cross direction, not capable of rot or mildew, from the presence of mucilage, and extremely durable, because it is subject to no irregular action of sharp cutting threads on its woof, but is only exposed to the fair, slow, and gradual wear of its well combined and duly proportioned component parts, which maintain their relative strength to the last.

In witness whereof, &c.

Account of an Improvement in the striking Part of an Eight-Day Clock.

By Mr. EDWARD MASSEY, *of Hanley, Staffordshire.*

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

A Premium of Twenty Guineas was presented to the Inventor.

HAVING for a number of years considered a method of striking a clock, at certain regular intervals, which I conceive may be of great service in making observations on the heavens, and ascertaining the velocity of sound, &c. I beg leave to lay before the Society for the Encouragement of Arts, &c. the model * of a striking-part of an eight-day clock, which I have no doubt will answer the purpose intended; and will I trust be found useful. They will find that the work of the model is less than that of the common striking movements, and may be made by a common workman, with less expense and trouble. The weight required is also considerably less. The principle I act upon is the pendulum, by which I regulate the stroke, instead of the fly; the advantage of which must be obvious to every one. The machine consists of a toothed wheel *a*, one pinion *b*, a pin wheel *c*, pallets *d d*, a pendulum *e*, and locking detent *g*. The hammer-work *f* is as usual, and strikes on the bell *h*. The weight hangs by a cord *i*. See Plate VI. Fig. 1 and 2, and where a front and side view of the machinery are given, and where similar letters denote the same parts in each view.

* Preserved in the Society's Repository for public inspection.

Descrip-

Description of the Machinery.

'I consider that it is only necessary for me to give the description of the wheels, so as to be a direction to a mechanic, who wishes to manufacture clocks on this principle. The main wheel *a*, with seventy-eight teeth, is to act in a pinion of eight leaves *b*. The pin wheel *c* should be large, so that the pins on which the pallets *d d*, and the locking *g* act, may be flung as far from the centre as possible, which pins may be eight or sixteen in number. If eight, the pendulum *e* should be about nine inches long, and it will vibrate twice betwixt each blow of the hammer; but if sixteen pins are put in the wheel, the pendulum must be about three inches long, and will make four vibrations betwixt each blow. The pins for drawing the hammer must be eight in number, and be fixed in a circle of about half the diameter of the aforesaid pins. The locking plate is on the main wheel. The stop is against the pins on which the pallets act, and may be discharged by a flirt piece.

As I have described the model, I beg leave to point out the method of striking a clock by the common pendulum, true seconds, without any additional pendulum or pallets for the striking part.

Description.

Fix a cantrite wheel, with sixty teeth, on the same arbor with a swing wheel of thirty teeth. Now suppose a striking part to be made in the common way of making an eight-day clock, so far as the pallet pinion, leaving out the warning and fly pinions. A crank piece must be fixed on the pallet-pinion, which must come into contact with the cantrite-wheel, which is fixed on the swing-wheel arbor. Then suppose the clock to

be

be set going, and the rack discharged, the pallet pinion will make a revolution on every vibration of the pendulum, by which means a clock will strike seconds as true as a pendulum vibrates, which I hope will be considered as useful for the purposes I have described. I also beg leave to observe, that a great advantage arises in both the above machines, from their not being liable to foul, as the stroke is given by the certain and regular vibration instead of the uncertain motion of the fly. Its advantage likewise depends on the cleanness of the work; and church clocks will be much benefited from the decrease of weight.

On the Application of Fell-Mongers' Poake as a Manure.

By JOHN GRETTON, *Esq.*

FROM HUNTER'S GEORGICAL ESSAYS.

THIS manure has, for ten years past, been used upon the stiff grounds in the counties of Surrey and Kent, which lie contiguous to London. The farmer removes it from the fell-mongers' yard in the dry months or hard frosts.

It is compounded of lime, hair, and scrapings of the pelts of sheep, &c. which have been dressed by the fell-mongers. There are two sorts, the white and the brown: the white is much the best, being more saturated with oil, lime, and hair; but they are both good, and go farther in dressing land than any manure whatever, in the proportion of four to one.

The manner of preparing it for the ground is as follows: Let your load be shot upon the head-land of the field you mean to dung (which must have been previously ploughed

ploughed up pretty deep); let it be spread upon this head land six inches thick at least, and not more than twelve, in order that it may dry and swell, which it will do in about a fortnight; thus go on till you have covered three parts of your head-land out of four; at the end of a month you will have as much fell-poake as will dress and cover the remaining fourth of the head-land: of course it must be taken from the heap, and carried upon it, at least six inches thick; when this is done, the whole must be turned, adding, as you turn it, as much of the head-land earth as could be got up to it: in this state let it rest at least one month, and not more than two. You may then cast it upon your fallows, either for turnips or wheat, in the proportion of ten or twelve large cart loads *per* acre. Land thus dressed escapes the fly if in turnips, and the worm if in wheat. It holds in the land three years and upwards.

If you mean to have a potatoe crop, get your fell-poake on your head-land by the latter end of October at the farthest, that it may dry and swell sufficiently for the head-land to be turned up with it by Christmas at all events: upon this range I advise a layer of good dung, at least a foot thick, and that it should be all well ridged and spatted up, to prevent its letting in too much wet, or crumbling down, and wasting in the winter. Let this range be turned and well chopped together in February; thus prepared, carry on your land in the proper season from twelve to fourteen loads an acre; spread it well, and plough it in with your last ploughing; then dibble in your potatoe sets; and, lastly, pass all over with a harrow, or not, just as the land lays. Thus also prepare for a barley crop.

It is to be observed, that if one head-land is not sufficient for finishing the field, you must take care to plough

plough up another; for it sometimes happens the head-lines are narrow, and of course not sufficient to carry fell-poake and dung for the whole field.

In the course of five years experience, I have discovered the very valuable properties of fell-poake as a manure over every other kind. It has the peculiar property of swelling, as it dries, to nearly one-half of its original bulk, yet of retaining its vegetative quality when at work in land.

It is a most excellent manure, taken by itself, in all stiff and wet soils; in which case six or eight loads *per* acre is quite sufficient, as the heaps may be laid small, because they will swell to a proper size for spreading in a short time. The land thus dressed, resists all approach of the fly and slug. It does not afford (as in common with other lands) shelter or food for vermin. I never saw a mouse or mole where it has been plentifully used; neither the red nor the canker worm, so fatal to the young shoots of all corn. It meliorates and renders stiff land slippery and ductile, by breaking its adhesive quality; land of this description will soon plough as light and free as the most kindly loam. It communicates its vegetative, yet repellant qualities, to the torpid earth of head-lands or pit-mud, if care be taken to let the latter dry before it is mixed with it.

Its strength is equal to twice that of horse-dung; it will hold in full power three or four, if not five or six years: in some lands it will extend to the latter. It is congenial to potatoes in a high degree; also to turnips, wheat, and barley. It is most excellent in destroying rushes and sedge in low wet meads. It is sure to destroy, and of course preserve the roots of cabbage and cauliflower plants from, the noxious effects of the worm, which perforates and clubs them: this I have also proved to a demon-

demonstration. Land dressed with it, mixed and well mingled with farm-yard dung and earth, as before stated, will produce one-fourth more than by any other manure.

Against all these advantages, I have only to say, I do not think it a fit dressing for light, loose, or thin land, whose bottom is chalk, gravel, or flint; but as I speak merely from conjecture, others are at liberty to try its effects, or not, as to them may seem best. My farm was stiff, upon a strong adhesive clay, and very holding land; but after I had used the fell-poake, sometimes singly and sometimes mixed, it soon yielded me profit on the one hand, and my horses ease on the other.

On improving small Arable Farms.

From Hunter's Georgical Essays.

It is generally thought, and on very good grounds, that small arable farms do not afford the occupier so good a maintenance as dairy farms of the same annual value; that the latter will do well and save money, while the former, with a vast deal more labour and trouble, is starving himself and family. A method of placing these two persons upon an equal footing is greatly to be wished. An attempt to effect which, is the intention of this essay.

The advantage and propriety of applying land to the growth of such articles to which nature has most fitly suited it, is well known, and also that all land, which is naturally and properly arable, can by no means be converted into meadow, or valuable pasture of any duration. Land overrun with furze, fern, bushes, and brambles, and

and which has been rendered fertile by means of the plough, must be kept in that improved state by its frequent use, otherwise it would soon revert to that wild barren state which was its original condition.

A farm, therefore, which consists wholly, or almost so, of land that is properly arable, must ever continue arable; for it is not practicable to render it in any degree fertile, but by means of the plough; or to keep it long so, even when it is made so. But though arable land cannot be converted into meadow or pasture proper for a dairy, it may be planted with articles which, it is well known, will answer the purpose of feeding horned cattle, especially milch-cows, as effectually as good meadow or pasture, producing as much milk, and altogether as rich, as sweet, and as good.

But the great interesting question is, Whether those articles which can be produced only by the heavy expenses of ploughing, harrowing, seed, and other operations which necessarily attend their culture and harvesting, will afford as much sustenance in proportion to the expense, as meadow or pasture which is liable to little or none excepting what is made into hay, the cattle gathering it for themselves as they consume it?

To ascertain this fact, we must inquire, what may be the average expense of keeping a milch-cow on a dairy-farm for any given time? It is said, upon very good authority, that the expense generally is from 3*l.* to 3*l.* 10*s.* *per annum.* Two acres and a half of pasture, fit for this use, is sufficient to keep a cow the whole year through, and such land is valued at from 25*s.* to 30*s.* *per* acre. At 25*s.* suppose, the keeping of each cow would amount to 3*l.* 2*s.* 6*d.* *per annum.* A dairy-farm, therefore, consisting of forty-eight acres, at 25*s.* *per annum*, would amount to 60*l.* rent *per annum*; and the number of cows

that

that might be kept upon such a farm, allowing two acres and a half to each cow, would be nineteen and a fraction, therefore we will say twenty.

In the next place, let us inquire, what would be the average expense of keeping a cow upon food raised in arable land as a succedaneum to grass, &c. rent and every necessary expense included?

We are assured, by unquestionable authority, that a bushel of potatoes, given half at night and half in the morning, with a small allowance of hay, is sufficient to keep three cows a day. On that allowance, their milk will be as rich and as good, and the quantity as great, as in the summer months, when the cows are in good pasture.

I take it for granted, that an acre of land, properly cultivated with potatoes, will produce 337 bushels, and that the total expense of cultivation, rent and tithe included, will be 6*l.* 13*s.* 7½*d.* If three cows eat seven bushels *per* week, they would eat 365 bushels in a year; and twenty cows would consume 2,433 bushels. The question then is, if twenty cows require 2,433 bushels to keep them a year, and, as above, an acre of land, properly cultivated, will produce 337 bushels nett, how many acres will be required to produce 2,433 bushels, or the quantity necessary to feed twenty cows to keep them in full milk the year round? The answer is, Seven acres and a quarter, nearly.

If then an acre of land can be cultivated with potatoes, as above, for 6*l.* 13*s.* 7½*d.* the cultivation of seven acres and a quarter will amount to 48*l.* 8*s.* 9½*d.* We have seen, as above, that the rent of a dairy-farm, capable of maintaining twenty milch-cows, is, upon a medium, 60*l.*; but it clearly appears, that the same num-

ber

ber of cows may be kept equally well on a very small part of an arable farm, planted with potatoes, for 11 *l.* 11 *s.* 2½ *d.* less than that sum, which is so much in favour of the arable farm; or, in other words, seven or eight acres of arable land, under this mode of management, are as much superior to forty-eight acres of meadow or pasture, as the difference of the two sums mentioned; the arable farmer receiving as great a sum for the expenditure of 48 *l.* 8 *s.* 9½ *d.* as the dairy farmer doth for his bare rent of 60 *l.* without reckoning a penny for incidental expenses.

It must be observed, that in this statement no allowance is made for the small quantity of hay given to the cows with the potatoes. It must be noted also, that the account of cultivation is charged with 40 *s.* an acre for manure, and some expense of ploughing, which of right is chargeable to the crop of wheat that is to follow. Now if we deduct 40 *s.* an acre from the expense of cultivating the potatoes, it reduces the sum to 4 *l.* 13 *s.* 7½ *d.* and the whole expense then upon seven acres and a quarter is only 33 *l.* 18 *s.* 9¾ *d.* and consequently the keep of twenty cows is little more than half to the occupier of the arable farm what it is to the occupier of the grazing farm. If this conclusion be fairly drawn, and the calculation free from errors, as I hope and believe, it is matter of the greatest importance, especially to the little arable farmer. It plainly raises him from a state of acknowledged great inferiority to one altogether as superior.

It may be said, this calculation respects potatoes only; how will this mode of culture answer when applied to the growth of other articles of food used as a succedaneum to herbage? Let us try.

By

By an experiment lately made, on a pretty large scale, by Mr. Vagg, it appears that cabbage, on arable land, is much about as superior to natural pasture as potatoes. His experiment was made on twelve acres of land, which was very far from being the most suitable for a crop of cabbage. The average value about 30 *s. per* acre; and the whole expense of the culture, carting off included, 1 *l.* 14 *s.* 1 *d. per* acre. The rent and expenses of cultivating the twelve acres then amounted to 38 *l.* 9 *s.* He says the stock he fed with it was forty-five oxen, and upwards of sixty sheep; that it fed them three months, and that he is very well assured that they improved as fast upon it as they do in the prime months of the season, May, June, and July. Now if, instead of sixty sheep, we reckon fifteen oxen, or that four sheep are about equal to one ox, in which we cannot err much; then sixty oxen were kept well for three months, or, which is the same thing, fifteen oxen for a whole year, for 38 *l.* 9 *s.* and consequently twenty would cost 51 *l.* 5 *s.* 4 *d.* which is not quite 3 *l.* more than the keep of twenty cows cost in potatoes.

It is somewhat extraordinary that two experiments, made on articles so very different in their nature, should so nearly coincide in their effects when applied to the same purpose. Turnips, turnip-rooted cabbage, carrots, parsnips, and some other articles, by many experiments often repeated, have been found quite adequate to the same valuable purposes, at least so far as to be more lucrative than meadow or pasture. I omit clover and ryegrass, because they have been long in general practice; but are in common very short of the advantages which may be derived from the cultivation of the other articles recommended.

There

There is one other article, however, which is particularly worthy of the arable farmer's utmost care and attention, which he may rely on with great confidence, if he will be at the pains of thoroughly cleaning his land, and of keeping it so for two or three years after it is sown. The article I mean is Sainfoin. From the miserable appearance it often makes the first year, I long doubted if its success in poor land was not very precarious; but I have now the fullest conviction, that it will grow and produce a very good crop in poor land, provided the soil be dry, and proper care be taken to keep it clean till it be fully established in the ground.

Small arable farms, which in a manner are quite destitute of herbage, cannot well be supplied with any substitute that is by any means its equal. Indeed one acre of good sainfoin is of more value than two acres of middling meadow or pasture. And as it will thrive so well on a very poor soil, the arable farmer, who either keeps no cows for want of herbage, or keeping them is pinched for food for them, is perfectly ignorant of the advantages attending the culture of this plant, or miserably indolent and inexcusable in not better attending to his interest.

Whatever crop precedes the sowing of sainfoin, the ground should be ploughed in the winter, and laid up in sharp deep ridges by one bout of the plough, to continue till the beginning of April. Then it should be dragged and harrowed level: and if the land be very poor, it should have some light dressing of ashes, soot, or a compost of lime, earth, and rotten dung, well incorporated together. A small quantity of either of these would greatly encourage the plants in their infant state. The beginning or middle of April, as the season may prove, the seed should be sown, and there would be little danger of its succeeding to one's wish.

Perhaps

Perhaps there cannot be a better nor a surer means of cultivating this very useful plant to the greatest advantage than by sowing it after potatoes. The horse and hand-hoeing them during their growth, and the ploughing, dragging, and harrowing the ground to clean it of the potatoes, so thoroughly destroy the weeds, and pulverize the soil, that it is made in the most perfect condition for a crop of sainfoin; and though the land may in its nature be very poor, the manuring properly for a crop of potatoes, and that being grown perfectly rotten, the soil is become sufficiently fertile.

Besides the above, perhaps there are very few articles in use as substitutes for pasture, that are equally profitable with carrots and parsnips, when the soil is suitable to their manner of growth and culture. The soil they delight and flourish most in, is a deep, light, free soil, which is easily penetrated, and moderately fertile. In such a soil, if properly hoed and set out at due distances, they will arrive at a great magnitude, and the acreable produce be very surprising. Another advantage is, their being so very acceptable to the farmer's stock of every kind. Horses, cows, sheep, and hogs, eat them seemingly with the same appetite, and are equally improved by them. Unfortunately the quantity of such land bears but a small proportion to what is totally unsuitable to them. Hard, stiff, obdurate land, and such as strongly coheres, is quite unnatural to them, and never answers the expense and trouble; what grows in such land being very short, generally forked, and of small value. Potatoes, cultivated as above directed, would, I think, be as good a preparation for those roots as can well be invented. If the soil be well manured for the potatoes, it will be sufficiently fertile for carrots and parsnips, and,

lying

lying through the winter in fallow, will be in excellent order for sowing the seeds of these roots the March following.

Upon the whole of this account, it seems clearly to follow, that an arable farm of 50 *l.* or 60 *l.* *per annum*, though it has not an acre of meadow or pasture land belonging to it, may, by skill and proper management, be made to produce as much and as good buttter and cheese as a dairy-farm of the same value, and have a large proportion of land left for the growth of corn and other purposes.

For instance; twenty acres of the sixty, I conceive, would be competent to the maintenance of the stock above mentioned, and they might be fitly divided as follows: *viz.* six acres of potatoes, two or four of cabbages, two of turnip-rooted cabbage, and two of turnips, making together twelve or fourteen acres; the remainder to be sainfoin; in all twenty acres. The proportion to be varied, and some articles to be exchanged for others, as the nature of the soil and particular circumstances might require, and as the farmer might think fit and proper. On twenty acres thus planted, I reckon, besides twenty milch-cows, six or eight young cattle, and pigs in proportion, might be well kept on the offal.

It may be asked, should this plan be generally adopted by the farmer, for whose use it is principally intended, if it would not be running out of one extreme into another? If so considerable an increase of milk, butter, and cheese, would not lower the prices of those articles too much, and raise the price of wheat in a greater proportion? That it would lower the prices of these articles is very certain, and it is a very desirable circumstance that it should.

There

There is little danger, however, of the price of wheat being advanced by the appropriation of about twelve acres of land annually to the cultivation of the above articles; for the land would be so much improved by the extra tillage given to the soil intended for those articles, and also during their growth, that I am rather of opinion they would produce more corn than if constantly planted in the usual very imperfect manner.

The greatest obstacle to this mode of managing a small farm (say from 20*l.* to 60*l. per annum*) is, the confined or narrow circumstances of the occupiers of such farms. In general, their capitals are much too small to carry on their business to any advantage in the present mode of management; but the mode recommended would require an increase of capital to the tune of 200*l.* or 300*l.* Less than 400*l.* would not stock a farm in this way of 60*l. per annum* at any rate; but a capital of 500*l.* would be vastly more convenient, and indeed much more to the farmer's advantage.

If the improvements proposed are so interesting to the individuals immediatety concerned, how very important are its effects in a political view, as it respects the community at large! If eight acres of land, by skill and management, can be rendered as productive and as profitable as forty-eight acres, whose natural produce is of a medium value, it is virtually increasing the extent of territory in a six-fold proportion, for if every acre of land could by art and industry be made to yield six times the quantity of produce it does at present, the whole might be rendered capable of supporting six times the number of the present inhabitants.

But this is far from being the whole of the advantage that will accrue from it. It will not only increase the quan-

tity of provisions as aforesaid, but it will also find abundance of employment for the poor labourer and his family. In this respect dairy-farms are in a manner of no use; they afford little or no employment at all for the poor labourers. Within a few miles of me lives a dairy-man, who milks constantly between twenty and thirty-cows. He has no wife, keeps only one maid-servant, has neither man nor boy to assist him, and only hires a woman in the neighbourhood to assist in milking night and morning, for which he pays 15 *d.* or 16 *d. per* week. This is his whole expense in the management of his dairy; scarce a tenth part of his rent; whereas every arable acre, cultivated with potatoes, &c. as above, will cost four or five times as much as the rent of the land they grow on. What an amazing difference doth this make to the poor of a populous country, and also to those who must either find them employment, or maintain them without any!

I have often employed a poor family in planting potatoes, and also in following the plough, and picking them up when harvested; a man, his wife, and two children about twelve or thirteen years of age. The man I paid 6 *s.* a week, the woman 3 *s.* and the two children 3 *s.* together 12 *s.*; a very pretty income for a poor family! At these times they usually got them a few clothes; at other times, when I had no employment for them, they have been often obliged to seek relief from the parish.

It is certainly a matter of great importance to all men in business, to do all in their power to promote the beneficial employment of the poor; it not only serves to alleviate a burthen, which in many places is become intolerable, but is also the surest means of keeping the poor honest. Many of them, I hope, would never have

thought

thought of being otherwise, if they had not been first impelled by necessity, who, from petty pilferings to get a penny, go on to greater thefts, till they at last arrive at the gallows; whereas, had they been constantly employed, they would have been neither necessitous nor idle — the two grand sources of all the evils they suffer, and the injuries they do to society!

Description of a Screw-Press with an expanding Power.

By Mr. WILLIAM BOWLER, *Finsbury-street.*

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

Ten Guineas were voted to Mr. BOWLER *for this Invention.*

THE screw and spring press will, I trust, be found in a superior degree adapted to the purpose of pressing bodies in general, but more particularly cheeses, apples, linen, &c. because such things require a firm and an unrelaxing pressure; and this is a peculiar advantage incident to this machine; for after it is set, or the spring screwed well up, it will be found, that as the article pressed shrinks from it, so the spring, owing to its peculiar expanding power, gradually follows the object of its pressure, and hence continues to maintain a uniform and equal action on the body on which it is placed. This in cheese-making will be found peculiarly advantageous; for it is from this very cause of want of sufficient pressing, that cheeses are frequently so very bad. Were the curd entirely separated from the impure and contaminating

mixture of the whey, which must be effected by the regular action of this machine, we should always have the cheese firm and wholesome; and I have not a doubt but that the press will be found equally useful in all other cases, and answer every purpose, even beyond expectation, to which it may be adapted.

References to Fig. 3, Plate VI.

a a, the two upright sides, or frames of the press.

b, the cross piece which connects the frame at the top, having a hole in the centre for the screw.

c, the strong block of wood, into which the two sides of the press are firmly mortised.

d, the box, in which the article to be pressed is placed. This box has a number of holes in its bottom, through which the liquid matter when pressed out passes, and is discharged from the mouth of the spout *e*, a small hollow being left under the box to allow its passage to the spout. A loose wooden cover fits into the box *d*, and upon it is fastened a stout piece of timber *f*, and an iron plate *g*, for the point of the screw of the press to act upon.

h, the male-screw of the press, working in a female-screw, in the centre of the strong piece *i*; which cross piece slides up and down in grooves within the two sides of the frame, one of which grooves is shewn in the engraving, and about half the length of the side piece.

k, the upper part of the iron screw, on which the handle *l*, which moves it, is placed upon a square. The iron of the screw is only wormed about half its length.

m, a strong spiral spring, made of iron wire, or iron rod, placed in the centre of the cross pieces *b* and *i*; this spring presses downwards against the cross piece *i*, forcing it as low down as the side grooves will permit. The male-screw *h* lies within the circle of this spiral; and

when

when the screw is turned, passes through the female-screw below it, and acts upon the iron plate *g*, under which the matter to be pressed is placed, by continuing to turn the screw. As it meets with resistance at the point *g*, it gradually forces back the cross piece *i*, by means of the female-screw within it, and compresses the spiral into a small space, between the two cross pieces, in which state it remains till the article which is pressed in the box begins to give out a part of its contents. The spiral spring *m*, compressed as above mentioned, then begins to expand, and exerts a continued re-action upon the cross piece *i*, on the male-screw *k*, the iron plate of which covers the article under pressure.

The male-screw is separated from the other parts, to shew how the thread or worm extends upon it.

A complete model of the above-described screw-press is reserved in the Society's Repository for public inspection.

On the Importance of Elastic Fluids in Vegetation, and on the Preservation and Application of Manures.

By R. Fenwick, *M. D.*

From Hunter's Georgical Essays.

It is my intention in this Essay to submit some reflections on the importance of elastic fluids in the process of vegetation, and to apply the principles I shall endeavour to establish to the purposes of agriculture, and more especially to the preservation and application of fold-yard manure. In the latter part I shall only advert to those points which have been either wholly neglected, or not duly attended to by agricultural writers, or by practical husbandmen.

When

When the animal and vegetable matters produced in our stables and fold-yards are thrown together in a heap, an internal motion soon takes place; the mass swells and heats, and a variety of elastic fluids are generated: after some time, the fermentation abates, the heap subsides, the heat decreases, and a portion of brownish liquor separates from the rest: at length the dunghill assumes an almost uniform soapy appearance, its temperature falls to nearly that of the surrounding atmosphere, and the extrication of gas is so inconsiderable, that it can only be distinguished by a peculiar odour. In this state, the writers on Agriculture contend, that the putrefactive ferment has ceased, and that a change has by it been effected in the dung, which has fitted it to act as a manure. It requires, however, but little attention to convince us, that this opinion is unfounded, and that the putrefactive process still continues in the state of manure, in the same manner as the vinous action exists in old wine, though it is not very perceptible to our senses. To prove this, it is only necessary to turn the heap, and the fermentation manifests itself afresh; and if this be done under favourable circumstances of warmth, moisture, and due access of air, the process continues until the whole is decomposed. Of the vegetable nothing then remains but a blackish residuum, called *mould*, which is formed of carbone, somewhat fat and oily, and from which water still draws a little extractive matter, and some saline substances. Reduced in the same manner, animal substances exhibit a portion of the same carbone, with some fixed saline substances, such as the phosphates of soda and lime, and a sort of mould, termed *animal earth*, which often retains a little sulphurated or carbonated hydrogen gas, fat, and extract. Now, and not sooner, the putrefactive process is completed.

The

The question, at what period the putrid ferment ceases, may at first appear of little importance; but, I trust, it will be found connected with many points deserving our attention, and that the establishing of just ideas on the subject may lead to valuable practical inductions. If it be taken for granted, that putrefaction produces a real change in the animal and vegetable matter, and that it is by that change only that they can be fitted to become the food of plants, the farmer will naturally be negligent of what passes in the early stages of that process, and, considering the elastic fluids that perpetually exhale as mere useless vapour, will confine his care to the mass which has undergone the supposed salutary alteration; but if he view putrefaction, not as an active process producing a real change in the substances subjected to it, but merely as the decomposition of organized bodies; if he be aware that, from its first commencement, a portion of the component parts of his dunghill (however carefully it may be sheltered) are incessantly exhaling, and that, if the process were supported, the whole would exhale, except the trifling residuum before spoken of, he will no doubt conceive that the more volatile parts are also deserving his notice, and endeavour, as far as possible, to retain them. The following view will convey a sufficiently clear idea of the subject.

Whatever variety of substances we find in vegetables, such as oils, salts, extractive matter, &c. it is certain that they are originally derived from the food of plants. The articles of which their food consists are, by the vital energy, formed into new combinations, and while that energy continues to act those combinations are preserved. No sooner is the vegetable dead, than a tendency to decomposition ensues; the union is soon dissolved, and the more volatile ingredients mingle with the atmosphere

atmosphere in the form of elastic fluids. Nothing can be more clear than that these volatile parts are applicable to the purposes of vegetation; for what, in truth, are they? If the various ingredients of vegetable bodies be no more than the food of plants moulded into new combinations by their living powers, and if putrefaction be only the dissolution of those combinations, then it will follow, that what is let loose by that decomposition is, in reality, the food of plants: neither ought we to suppose that the parts which thus escape are in small quantities, and therefore unworthy our attention; for the process of putrefaction shows, beyond a doubt, that by far the greater part of animal and vegetable substances which are subjected to putrefaction, assumes the form of elastic fluid. I am now speaking of putrefaction conducted under favourable circumstances: for where there is a deficiency of caloric, and redundancy of want of moisture, the new combinations will be made in different proportions; and much that would (if caloric had abounded) have united with it, and assumed the gaseous form, will, under these circumstances, be found in a more fixed state. Whatever difference is observable in the decay of vegetable or animal matter, under different external circumstances, may be explained by an attention to these points.

As vegetable matter, when its organization is destroyed, chiefly assumes the aërial form, I have long thought it probable, that the food of plants is, in a great measure, inhaled by them in that form, or, in other words, that elastic fluids are the chief food of plants. As this opinion, if rendered probable, would strongly enforce the necessity of that attention to the gases of our dunghills, which it is the chief object of this Essay to recommend, I shall here submit the reasons which have induced me to adopt it.

1st.

1st. It has been found, upon examination, that the fertility of soils is in proportion to the elastic fluids they contain.

2dly. Carbone, which is almost the only fixed ingredient of plants, and is by far the most abundant, is insoluble in water, or in the acids which are found in soils; it is only, therefore, as united with azot or oxygen, in the forms of carbonated azotic gas, or carbonic acid gas, that it can enter the absorbents of plants. The extreme tenuity of those vessels renders it impossible for it to enter them in the most intimate diffusion.

3dly. We know that plants live and thrive in many of the chemical airs, and we have also undoubted proofs that they decompound them: the vessels, therefore, of plants are adapted to act upon elastic fluids, and (if I may be allowed the term) to digest them.

4thly. The primary substances from which all vegetable matter is formed, are all found in the state of gas, *viz.* azot, hydrogen, oxygen, and carbone.

5thly. It is in favour of this opinion, that it affords us a ready explanation of the manner in which heat promotes vegetation; as, without its agency, no substance can assume the gaseous form.

6thly. Even water, which has been supposed the sole food of plants, is most favourable to vegetation, when applied under circumstances which produce its decomposition: hence the vigorous growth of plants in warm moist airs, in an atmosphere loaded with the electric fluid, and in copious dews: even when water is artificially applied, it is most beneficial when it is exposed to decomposition by being made to ripple over an extended surface of soil, as in the practice of irrigation. On the same principle, we can explain why cold rain rather checks than invigorates vegetation.

 7thly.

7thly. Perhaps the very extensive and complex apparatus of air-vessels which we find in plants, may be adduced as an argument in favour of our theory; if it be admitted, we shall consider them as the *primæ viæ*, or intestines of plants, as the digestive organs in which they first elaborate their food, and adapt it to the various purposes of their economy.

8thly. If vegetable matter be made to decay in a low temperature, and drenched with a redundancy of water, it is found, when rotted, to be of little or no use as a manure: under these circumstances, only a very small proportion of gas is generated. If the same matter fall to decay without a due proportion of moisture, or, if a proper quantity of moisture being present, there be a deficiency of heat, the decayed mass is, in the same manner, found inactive as a manure; it is only where the decomposition takes place under circumstances favourable to the formation of elastic fluids, that it is effectual in favouring vegetation.

These reasons have induced me to believe, that elastic fluids are probably the chief food of plants; I shall therefore next consider how far this view of the subject ought to influence our practice.

The first particle which flies off from a putrifying vegetable, is as completely fitted to become the food of plants, as if the whole had thoroughly fermented; its former combination is dissolved, and it is prepared to combine anew; it follows, therefore, that we ought, as far as possible, to retain the volatile parts, which are thus incessantly wasting. But although this conclusion be sufficiently evident, it is very difficult to carry our views into execution. Some waste is unavoidable; the moment that dung is dropped, a part is separated in the form of elastic vapour, and is lost. But this is not all.

In

In order to subject the animal and vegetable matter, which is swept from our fold-yards, to putrefaction, it is necessary to collect it in considerable heaps: it is some time before these can be collected, and while that is doing no precaution can be taken. When it is so collected, were we, without delay, to plough it into the soil, all fermentation would cease; and the same would happen, were we to prevent the admission of air. These difficulties cannot be wholly overcome, but they may be considerably obviated.

We know there is a tendency to combination between soil and gases, which are generated in putrifying substances; by this combination soils are fertilized, and it is in consequence of it that the farmer derives benefit, by adding soil to his compost. If then we can bring the airs which arise from our dunghills into close contact with soil, we may reasonably suppose, that no inconsiderable portion of them will be retained by it. For this purpose, let a portion of surface soil, or any light earth, be strewed as soon as may be on the dunghill; if the quantity thrown on be not too large, it will not check the putrefaction: after a time, let this soil be mingled with the dung, or, if the fermentation should not be active, let it be thrown off, and heaped up beside it, and then another portion be laid on the dung, as at first. Thus, by degrees, we shall form the most valuable materials for composts, and profit by those active principles which are, in the present practice, inconsiderately wasted; peat-earth will answer better than any other for this purpose, both as the lightest, and as it abounds in vegetable matter, which, under this treatment, will be converted into a valuable manure. As it is evident, that the sooner dung is fitted for use, the more profit it will yield to the farmer, and the less it will be wasted, it is well worth

 attending

attending to the means of accelerating its putrefaction. In warm weather, sprinkling the mass now and then with water will have a good effect in this point of view, as is well known to gardeners; and it is probable, that the addition of a portion of rotten dung to the recent heap might have the same effect, upon the same principle that yeast communicates its peculiar action to farinaceous substances.

Besides these precautions, it is worth inquiring how far it is necessary for dung to be in so advanced a stage of putrefaction before we use it. I have already observed, that if it be ploughed into land before its fermentation is somewhat advanced, the process will be stopped; but when it has once pervaded the mass completely, we may mingle it with the soil without any such effect, provided the field be duly prepared to receive it. It must be ploughed and harrowed in immediately; and I have the authority of one of our most intelligent and experienced farmers for asserting, that half-rotted litter, used in this manner, is of more advantage than it would be, if kept at the farmstead until thoroughly rotted. It may be proper to remark, that the richer soils are, or, in other words, the more elastic fluids they contain, the more favourable they are to the continuance of the fermentation of the dung ploughed into them; and also that the soil should be previously well broken down and lightened; to this I alluded, in stating the necessity of the land being duly prepared to receive it.

I have thus far treated of the preservation of manure, and shall now state some things concerning its application.

If elastic fluids are of so much importance to vegetation, it will follow, that manure ought to be applied under circumstances which favour their generation: these chiefly

chiefly occur in spring, after the grass has covered the land in some degree, or the annual crops attained some height, that the dung may be shaded from the sun, and not exposed to too much drought; or else early in the autumn, after the hay crop is removed, and the aftermath has made its first shoot. These will, I have no doubt, be found decidedly the best times; but if the latter be chosen, the farmer will loose the eatage of his aftermath, a circumstance which will render it generally unadviseable in seasons when fodder is scarce, but which, at other times, will greatly contribute to the improvement of the land which is manured. Besides its being unfavourable to the generation of elastic fluids, there is another reason against spreading dung in winter, and that is, that as vegetation is then extinct or languid, plants are not capable of benefiting by the nourishment provided for them. In the warmer seasons, on the contrary, their growth immediately becomes more rapid, no part of the manure is allowed to escape, and at once a more immediate and more ample return is made to the farmer.

I shall close this Essay by observing, that it would be difficult to devise a worse manner of using dung than that which is almost universally practised in this country on grass-land. When a severe frost has bound up the land in a state of impenetrable cohesion, perhaps when snow has covered it, farmers wheel on their dung. While the frost lasts, the land can derive no advantage from the manure; and when a thaw supervenes, it is evident that the wash from melting snow, or from the rains which generally fall in such weather, must deprive the mass of every part that is soluble: the ground, in the mean time, retains tl e frost for many days, and is therefore incapable of absorb ng the wet which falls upon its surface; and

even

even when the influence of the milder air has reached it, it can imbibe but little, being in general previously filled with water, and the quantity which flows over it being too great for the soil, under any circumstances, to drink up. There can only be one reason assigned in favour * of this destructive custom, (for the plea of convenience cannot be admitted in a case of such importance,) and that is, that manure, when spread early in the winter, guards the roots of grasses from frost. This I have heard alledged, but it is an error. Perennial grasses do not suffer by frosts, as is well known to every farmer; and if broad clover, which is a biennial, be destroyed by frost, we have good authority to believe, that it is no less certainly injured by the application of manure, when it is not in a state of vegetation. But should this be disputed, it will still remain true, that where it is necessary to guard the roots of grasses from severe cold, it will be best done by manuring at the times already recommended, and by freeing the pasture early, and leaving it tolerably rough in the autumn. It is therefore to be hoped, that this slovenly and unthrifty use of dung will not be long persevered in by any man who is capable of looking to a better authority than that of long-established custom.

* Farmers spread their dung in winter, because it is a season when their servants and horses are least employed; and they do it in frost, that they may not injure the sward: but the sward will not be injured if they apply their manure in summer; and it is surely a bad excuse for doing any thing at an improper time, to say that you had leisure to do it.

Description

Description of a new Log to ascertain the Longitude at Sea, by the Aggregate of a Ship's Way compared with the ordinary Log. With an Engraving.

From the ANNALES DES ARTS.

THE ordinary log, (Fig. 2, Plate VI.) is a triangular piece of plank, to which is fastened a cord with three knots, a certain number of fathoms distant from each other. This plank is thrown overboard by the pilot, who lets the cord run for half a minute, and then counts the knots. If three knots are run off, the vessel is supposed to be going at the rate of three miles an hour; and if eight knots and a half are run off, it is concluded that the ship is proceeding at the rate of eight miles and a half. But these calculations cannot be accurate: 1, because the plank is not fixed during the progress of the ship: 2, because the progress of the vessel is always unequal: 3, because the pilot may run off the line too quickly or too slowly: 4, because a strong or a light breeze, at the moment when the log is thrown into the sea, may produce an error in the reckoning: 5, because when seven or eight knots are run off, the force of the wind acts upon a surface very different from that when the wind is more moderate, and when the vessels proceed at the rate of but three or four knots: 6, because a wave may drive the plank nearer or to a greater distance: 7, because pilots commonly omit to count the fathoms of line exceeding the number of knots. From all these disadvantages, therefore, the pilots frequently find themselves 100 leagues out of their reckoning.

By the new log we are about to describe, which is the invention of M. Le Guin, all those imperfections are corrected.

EXPLA-

Explanation of Plate VI.

Fig. 1 represents the new log, and Fig. 2 the old log, of which we have just spoken.

The new log, Fig. 1, being fastened to the stern of the ship by the cord 1, at a proper distance *, the shock of the water causes the screw 2 to turn round on its axis. On the stem of this axle is a screw, which sets in motion the machinery 3, 4, 5, and 6, constructed in such a manner that while the great wheel makes one turn the endless screw 2 makes 240,000, and the number of turns of the endless screw is indicated by a needle on the wheel 6. This wheel has 100 cogs, the wheel 4 has 40, and 3 has 60.

From these statements this log may be made of the same proportion, and tried. Those who make trial of it at sea must take it out of the water when the vessel has proceeded one league; they must examine to what number the index of the great wheel points, which will certainly not have made one turn. This number they must note down, and, to ascertain the utility of the log, they should repeat their experiments both in moderate winds and heavy gales.

Supposing at the end of a league that the index points to 88 with a moderate wind, and to 76 with a high wind, it will be easy to find the mean of this equation, and to confirm, by a calculation, or by this measure of the ship's way, the distance she has proceeded.

M. Le Guin made an experiment of about 100 leagues with his log: the wheel No. 6 gave 20 cogs *per* league, and 19 with moderate winds.

This log is intirely constructed of copper.

* M. Le Guin having suspended this log at a certain depth in the water by a cork floating on the surface, the experiment proved that this precaution was unnecessary.

Description

Description of an Instrument or mechanical Medium, giving the Result of difficult Calculations, which it is necessary to make at Sea, in order to obtain the Longitude.

With an Engraving.

From the ANNALES DES ARTS.

THE instrument, which is the subject of this memoir, was invented in 1790, by M. Etienne Le Guin. About the end of that year he submitted it to the examination of Messrs. Van Swinden, Niewland, and Hulst Van Keulen, Commissioners of Longitude at Amsterdam, who made the most flattering report concerning it

This instrument (see Plate VI. Fig. 3.) is composed of a compass with four legs, two of which, A and B, move in the same line, while the two others, C and D, move in a vertical direction to the former, The four points meet when the compass is shut. The second figure is a semi-circle, divided into degrees and half degrees, and on which the minutes are indicated by a nonius *. On the circumference of the circle there is a point, or rather a very small cavity S, and a similar one on the nonius at X. Into these cavities the points of the two legs of the compass must be put, to measure their distance, which is then indicated by the degrees and minutes marked by the nonius.

* It is obvious that this semicircle must be accurately divided; this can be done only by means of an instrument like Ramsden's, or that by Van Keulen, of Amsterdam.

Use of the Instrument.

This instrument is principally employed for reducing, to the true distance, the apparent distance of the centre of the moon from the centre of the sun or a star. It is sufficient to know the corrections which it is necessary to make in the true altitudes. This instrument likewise serves to measure the horary angle and the azimuth; and is of great utility in resolving, without calculation, all the problems of spherical trigonometry.

Operation for reducing the apparent Distance to the true one.

I. With the legs B and C, (Fig. 3, Plate VI.) take the apparent altitude of the centre of the sun or star; and with the legs A and D the apparent altitude of the centre of the moon; lastly, with the legs C and D the apparent distance of the centre of the moon from the centre of the sun or star; which is done by opening the legs A and B till the legs C and D are at the requisite distance, taking great care not to suffer the legs C and D to move on their axes. To this point particular attention should be paid in all subsequent operations.

II. Deduct from the sun's altitude ten times its correction, and with the legs B and C take this altitude, thus diminished, but without touching the legs A and B. With the legs A and D, observing the same precaution, take the sum of the moon's altitude, and ten times its correction. Lastly, move the nonius till it indicates the distance at which the legs C and D then are, and note down that distance.

III. Add to the sun's altitude ten times its correction, and measure the sum with the legs B and C without touching

touching A and B. With the legs A and D take the moon's altitude, subtracting ten times its correction; then move the nonius till it indicates the distance at which the legs C and D are, and note down that distance.

IV. Take the difference between this sum and that of the distance found in No. II. Multiply that distance by three, reckon the degrees as minutes, the minutes as seconds, and you will obtain the correction that ought to to be made in the apparent distance, in order to find the true distance.

Add the correction to the apparent distance if the first number be greater than the second; subtract it if the second be greater than the first.

Detailed Example.

Observation I. Having, on the 11th of June, 1791, taken the distance of the moon from the sun, the apparent distance of their centres was found to be 116° 39′ 43″

The altitude of the sun's centre at the same moment - - - - - - - - - - -	18	52	50
That of the moon's centre - - - - -	44	27	10
II. Apparent altitude of the sun's centre	18	52	50
Correction by the tables 2′ 30″ multiplied by 10 - - - - - - - - - - - - -	0	25	0
Difference - - - - - - - -	18	27	50
Appparent altitude of the moon - - -	44	27	10
Correction by the tables 39′ 42″ multiplied by 10 - - - - - - - - - - - - -	6	37	0
Total - - - - - - - - -	51	4	10

III. Apparent altitude of the sun - -	18°	52′	50
Its correction multiplied by 10 - - - - -	0	25	0
Total - - - - - - - - - - -	19	17	50
Apparent altitude of the moon - - - - -	44	27	10
Its correction multiplied by 10 - - - -	6	37	0
Difference - - - - - - - - -	37	50	10

Detail of the Operation.

I. Fix the nonius at 18° 53′ 50″ : *c a d* at 18° 52′; place the point of the leg B at S, and open the compass till the point of the leg C is exactly at X, and you will have the sun's altitude.

Then fix the nonius at 44° 27′ 10″, or at 44° 27′, and place the point of the leg A at S, and that of the leg D at X, and you will have the moon's altitude.

Then fix the nonius at 116° 39′ 53″, or at 116° 37′ 43″; open the legs A and B till the point C being placed at S, the point D will stop at X, and you will have the apparent distance.

N. B. Great care must be taken lest the legs D and C move upon their axes during the operation; and in all the others, lest any alteration be made in the extension of the legs A and B. The angle which they form ought to remain invariable.

II. Fix the nonius at 18° 27′ 50″, or at 18° 28″: place the point B at S, and bring C exactly to X. You will then have the sun's altitude, *minus* its correction multiplied by ten.

Fix the nonius at 51° 4′ 10″, or at 51° 4′: place the point A at S, and open the compass till the point D stops

at

at X. You will have the moon's altitude, *plus* its correction multiplied by ten.

• Place the point C at S; move the nonius till the point D stops at X, and note down the arch which it gives, and which in this case will be 110° 13′.

III. Fix the nonius at 19° 17′ 50″, or at 19° 18′: place the point B at S, and the point C at X. You will have the sun's altitude, *plus* its correction multiplied by ten.

Fix the nonius at 37° 50′ 10″, or at 37° 50′: place the point A at S, and the point D at X. You will have the moon's altitude, *minus* its correction multiplied by ten.

Place the point C at S, and move the nonius till the point D comes exactly to X. Stop the nonius, and note down the arch which it indicates. It will here be found to be 122° 37′.

Conclusion of the true Distance.

IV. The first distance found in the second part of the operation was - - - - - - - - - -	110°	13′	0
The second distance found in the third part of the operation was - - - - - - - -	122	37	0
Their difference is - - - - - - - - -	12	24	0
Which, multiplied by 3, gives - - - -	37	12	0
Taking the minutes for seconds, and the degrees for minutes, you have for the correction - - - - - - - - - - - -	0	37	12
Which being deducted from the apparent distance 116° 39′ 43″, give for the true distance - - - - - - - - - - - - -	116	2	31

Remark.

Remark on the Principle of the Operation.

Supposing that when taking, in the second operation, the apparent altitude of the sun, *minus* its correction multiplied by ten, and in the third the sun's altitude, *plus* its correction multiplied by ten, the point C comes first to H and then to G: and that when taking in the second operation, *plus* its correction multiplied by ten; and in the third, the moon's altitude, *minus* its correction multiplied by ten, the point D comes first to L and then to K; it is clear that the arches G H and L K will be equal to the correction of the altitude multiplied by 20, and that, thus, by subtracting from each other in the first operation, the reduced distances L K and H G from the points D and C, which have been found in the second and third operation; their difference will be equal to twenty times the correction that must be made in the apparent distance; and that therefore, by multiplying this difference by three, you will have sixty times the correction; but if the degrees be taken for minutes, and the minutes for seconds, you will have the correction itself.

It appears, at first sight, that it would have been more simple to conduct, in the second operation, the points C and D to F and E; that is, to the arches which are the sun's altitude, *minus* its correction, and the moon's altitude, *plus* its correction; that is, the true altitudes of the sun and moon: in which case the distance F E of those two points would have been the true distance. But here if an error of one minute be committed in the operation, that error is completely retained in the reduced distance; while, by the method employed, only a twentieth part of this error appears in the corrected distance.

To find the longitude by means of the observed distance, it is not sufficient to have reduced the apparent distance

distance to the true one; it is necessary likewise to know the time of day on board at the moment of the observation, as well as the time of day at the place for which the almanack you make use of is calculated; for instance, Greenwich, Paris, Teneriffe, &c.

To ascertain the time of the day, it is necessary, in the first place, to be acquainted with what is called the horary angle of the sun or star; that is, how many degrees of the equator the star is removed from the meridian, if it be previous to its having passed the meridian.

This horary angle is calculated by spherical trigonometry; but it may be measured with great ease by the instrument which has just been described.

In the following example we will suppose ourselves at 20° south latitude; that the true altitude is 18° 50′ 20″, and the declination 23° 7′ 20′, as it is on the 11th June, 1791.

Operation for the horary Angle.

1. Fix the nonius on the arch which indicates the declination of the sun or star (in this instance 23° 7′). Place the point B at S, and the point C at X, observing that the point C ought to be on the same side if the latitude and declination are both either north or south; but, on the contrary, if (as is here the case) one be north and the other south, you will have the declination.

2. Fix the nonius at the arch (here 20°) indicating the latitude in which the ship is; place the point A at S, and the point D at X, and you will have the latitude.

3. Fix the nonius at the arch, which is the *complement* of the altitude of the luminary, that is the difference between 90° and that altitude (here 71° 9′ 40″, or 71° 10′). Fix the point C at S; open the arms A and B till the point D comes to X, carefully keeping the points C and D from moving

moving on their axes. You then obtain the arch which is the total altitude.

4. Place the point A at S, and move the nonius till the point B comes to X. Fix the nonius. The arch that it indicates is the horary angle, which must be converted into time *, and you will have the hour if the question relates to the sun † ; in this instance it will be 3h. 52′ 14″.

Conclusion for the Longitude of the Ship.

To obtain the longitude, that is, the distance between the meridian for which the almanack is calculated ; that of Greenwich for instance, and the meridian of the place of observation ; you must know what hour it is at Greenwich at the moment of the observation ; that is, at the moment when the true distance of the sun and moon corresponds with that which has been found. I therefore seek in a nautical almanack, an English one for example, and find that on the 11th of June, 1791, the distance of the moon from the sun is 114° 44′ 49″ when it is three o'clock at Greenwich. But observation gives me 116° 2′ 31″ ; the difference of these two distances is 1° 17′ 42″. If I subtract the distance for three o'clock, that is, 114° 44′ 49″ from the distance for six o'clock, that is, 116° 24′ 4″, the difference of those two distances will be 1° 39′ 15″. I therefore say, 1° 39′ 15″ are to three hours, during

* It is well known that 15 degrees are equal to one hour ; consequently one degree is equal to four minutes, and one minute to four seconds. But there are tables which serve to facilitate this operation.

† When a star is the subject of observation, the horary angle indicates only the angle which the star makes with the meridian. To reduce it to time, either add it to, or subtract it from, the hour at which the star passes the meridian, and then make a correction for the remainder, on account of the acceleration of the star.

which

which this variation takes place, as 1° 17′ 42″ (which must still be the distance between the moon and the sun) are to a fourth term, that is found by the rule of three to be 2 h. 21′ 12″, and which shews that the true distance deduced from observation; namely, 116° 2′ 31′ will take place at Greenwich, at 5 h. 21′ 12″. Therefore as it is then only 3 h. 52′ 14″ on board the ship, the difference of the meridian of the vessel, from that of Greenwich, will be 1 h. 28′ 58″, or 22° 14′ 30″ West. Reduced to leagues, at the rate of 20 to a degree, this would make 445 leagues under the equator; but as the vessel is in latitude 20° there is a distance of only 418 leagues between the meridian of the vessel and that of Greenwich. There are, however, tables that are very convenient, and render unnecessary the above-mentioned process, by the rule of three.

Finally, after obtaining the difference of longitude between the meridian of the vessel and that of Greenwich, for instance, notice should be taken whether it is west or east. In the calculation of the hour by the meridian of the almanac, at Greenwich, for instance, attention must be paid whether the moon is removing from the star or approaching it.

Method of calculating the Longitude by only one Observer.

The foregoing operation requires three observers to be employed at the same moment, one to take the altitude of the sun; another, that of the moon; and the third, the distance of the two luminaries. But if, by means of a good watch regulated accurately, and not long before by the horary angle, you know exactly the real time at the moment of the observation of the distance, there is no occasion to observe the altitude of the sun, and one observer only is sufficient. He must take the altitude of

the moon, either before or after taking the distance, and note down the hour which is then indicated by the watch.

Supposing, therefore, that an observation was taken on the 11th of June, 1791, at 20° S. latitude, precisely at 3 h 52′ 14″ P. M. of the apparent distance of the sun and moon, and that of their centres was found to be 116° 39′ 43″; and that two minutes before an observation was taken of the moon's altitude; the question is, to find the apparent altitude of the sun, and that of the moon, at the moment of the observation, and to deduce from thence the true distance.

Altitude of the Sun. Open the legs B and C, so as to subtend an arch equal to the latitude of the place: in this case 20°.

Open the legs A and D, so as to subtend an arch, equal to the declination of the sun (here 23° 7′ 20″) observing that D should fall on the same side as C, if the latitude and declination are of the same denomination; if otherwise (as in this case), on opposite sides.

Open the legs A and B, so as to subtend an arch equal to the horary angle, and consequently the points of the legs D and C will subtend an arch, which will be the complement of the true altitude of the sun, (here 18° 50′) whence the true altitude may be deduced, and by adding to this true altitude the correction of the altitude, you obtain the apparent altitude of the sun at the moment of the observation, that is, in this instance 3 h. 52′ 14″.

Altitude of the Moon. Open the legs B and C, so as to subtend an arch equal to the latitude of the place.

Open the legs A and D, so as to subtend an arch equal to the moon's declination, at the moment of observing the moon's altitude, paying attention to take D on the same side as C, according as the latitude and the

decli-

declination are of the same, or of a contrary denomination.

Open the legs A and B, till the legs D and C subtend an arch, equal to the complement of the moon's apparent altitude.

The legs A and B will then subtend an angle, equal to the horary angle of the moon, at the moment of observing the moon's altitude; but this angle is too small by 2′ of time, which to the moon are equal to 31′ of a degree: Therefore, 31′ must be added to the arch subtended by the legs A and B. Take again the arch subtended by the points C and D, after the arch subtended by A and B has been thus augmented. This arch is the complement of the moon's apparent altitude at the moment of the observation: subtract it from 90°, and you obtain the apparent altitude.

It should be remarked, that if the observer takes the moon's altitude after taking the distance, he ought to subtract from the arch, formed by the points A and B, 29 minutes of a degree *.

True distance. Having thus found the apparent altitudes of the moon and sun at the moment of observing the distance, proceed as in the ordinary operation to reduce the apparent to the true distance.

Resolution of all the Spherical Triangles, by the same Instrument †.

Case I. Three sides being given, to find the angles.

1. Elevate the leg C over the leg B, by the complement B S, of one of the given sides P S, fig. 3; but if

* 30′ is what ought to be added or subtracted for two minutes of time; but as the moon advances one minute of a degree in two minutes of time, this makes it 31′ and 29′.

† The remainder of this article is by Messrs. Van Swinden and Niewland.

 this

this side P S exceed 90°, make C as much lower than B, as the excess B S of the side P S above 90°.

2. Proceed in the same manner with the leg D, in regard to the leg A, for the second side P T, fig. 3 and 4.

3. Shut or open the legs A and B, as much as the points D and C are distant from the value of the third side T.

4. The arch subtended by the points A and B will be the value of the angle T P S, formed by the two first sides T P and P S; the angle measured by the arch E B, which is precisely the same as that subtended by the above-mentioned legs.

5. The same process is employed successively for the angles S T P and P S T.

N.B. If one of the first sides employed, that is, one of those which comprise the angle you are seeking, is of 90°; the points of the compass C and B, or A and D coincide. In this case employ only A or B, which then represent A and D, or B and C.

Application of the horary angle. The horary angle is properly the angle T P S. in the spherical triangle T P S, if P is the pole, T the zenith, S the place of the luminary, K H O the horizon, E B Q the equator, and consequently E T is the latitude, P O the altitude of the pole, equal to the latitude, B S the declination of the luminary, S H its altitude. And, if the operation we have described for finding the horary angle be compared with this solution of Case I. it will be found exactly the same.

We have, in fact, taken, 1. with the legs C B, the declination B S, complement P S, distance of the luminary from the pole or excess of P S above 90°; 2. with the legs A and D, the latitude E T, complement of T P; 3. with the legs C and D, T S the complement of the

the altitude S K; and 4. the arch E B, subtended by the legs A and B, was the measure of the horary angle.

Application to the azimuth. The azimuth is the angle S T P, formed at the zenith by the arches T S and T P, and measured on the horizon by the arch H O. This being laid down, proceed to resolve the triangle S T P, the three sides of which are given, T S the complement of altitude, T P the complement of latitude, P S the distance from the pole.

Take therefore,

1. With the points A and D, the arch P O, or the latitude, the complement of T P.

2. With the points B and C, S H or the altitude, the complement of T S.

3. Open the legs A and B, till the points D and C subtend P S, the distance from the pole.

4. And then the points A and B will measure the arch H O, that is, the azimuth.

Application to the amplitude. The amplitude is nothing more than the azimuth, in case the luminary is in the horizon: thus it is the arch H O, and the side T S, the complement of altitude becomes T H$=$90°. The points B and C are made to coincide; that is, the point B represents both itself and the point C.

Case II. Two sides T P and P S, together with the angle T P S formed by them, being given: the third side T S, and the other angles are required.

1. With the legs B and C of the compass, take the arch E T, the complement of one of the sides P T, or if that side exceed 90°, the excess of the side above 90°.

2. With the legs A and D take the arch B S, the complement of the other side P S, or if that side exceed 90°, its excess above 90°; observing generally as in fig. 4, if the two sides be of different kinds, the one smaller and the

the other larger than 90° ; to place the legs C and D on different sides, one above and the other below the horizontal legs A and B ; but if the two given sides T P and P S be of the same kind, (fig. 3.) the points C and D must be placed on the same side, both above or both below the legs A and B.

3. With the points A and B, take the value of the given angle T P S, which is measured by the arch E B.

4. And the distance of the points C and D, will be T S, the third side sought.

5. To find the angles, they must be sought as in the first case.

Application to the question of the altitude of a luminary; the declination, horary angle, and latitude being given.

If the solution given above, page 138, for finding the altitude of the sun, be compared with the resolution of the preceding triangle, it will be found exactly the same: for we have taken,

1. With the legs B and C the latitude, that is, the arch E T, the complement of the side T P.

2. With the legs A and D the declination ; that is, the arch B S, (fig. 3.) or the excess of that side above 90° (fig. 4).

3. With the legs A and B the horary angle, that is, the angle T P S, or the arch E B.

4. And the distance of the legs C and D, gave us the complement of the altitude sought, that is, the third side T S, the complement of the altitude S H of the luminary.

Case III. Two sides, T S and S P, of the triangle T S P, being given with the angle T opposed to one of them, the third side and the angles are required.

Here it is necessary to begin with seeking the third side.

1. With

1. With the legs A and B, take the given angle S T P, which is measured by the arch H O.

2. With the legs D and A, take the complement (S H) of the side (S T) adjacent to the given angle; or the excess of that side above 90°, if the side T S be upwards of 90°; that is, raise D above A, or depress it below A, as much as is deficient.

3. Change the distance of the leg C, from the leg D, by moving C nearer to, or farther from B, till the distance of C from D is equal to the second side S P.

N. B. Great care must be taken that the distance of the legs A and B, may not vary in this operation.

4. The distance of the points B and C, will express the complement (P O) of the third side T P, or its excess above 90° accordingly as the leg C is elevated above B, or depressed below it.

It will sometimes happen in the present case, that in N° 3, the point C may, in two different positions, be removed from the point D, the distance required. This case is necessarily doubtful in point of theory, and it may be proper to observe, that this case only is in that predicament, when operating with this instrument, and that because it is indeterminate in its nature; while with calculation, incessant attention is required to the nature of the angles or sides that are employed, and in this instance particular rules are even necessary to distinguish the circumstances, when the case is not doubtful from those when it is. That attention is not required when using this instrument, which reflection must recommend it even to calculators; who, in consequence of this, sometimes find themselves embarrassed with difficulties, still greater than the calculation of the triangle.

5. After finding the third side, follow Case I. for the angles.

Case

Case IV. When the three angles are given, or two angles and the side comprehended between them, or two angles and the opposite side, Fig. 5.

This case cannot be resolved, but by operating with the supplementary triangle *s t p*, in which each side *t p*, *s p* is the supplement of the angle S, P, or T, to which it is opposed in the given triangle S T P, and each angle *t p s*, the supplement of the side S P, S T, and T P, to which it is opposed in the given triangle S T P.

1. If the three angles be given,

Take the side *p s* the supplement of the angle T.
——— *p t* ——————— S.
——— *t s* ——————— P.

operate on these three sides according to Case I. and you will, in consequence, find

The angle *t* the supplement of P S }
——— *p* ——————— T S } which are the
——— *s* ——————— P T } sides sought.

2. If the two angles T and S, and the side T S, comprehended by them be known,

Take *p s* the supplement of the angle T }
—— *p t* ——————— S } given,
—— the angle *p* ——— of the side T S }

and by Case II. you will find the third side *p t*, which is the supplement of P, the angle sought.

Then, according to Case I, by means of *p s*, *p t*, and *s t*, the three sides known, seek the angle *s*, the supplement of P T, the side sought, and the angle *t*, the supplement of the side P S.

3. If the two angles T and S, and the opposite side T P be known.

Take in the supplementary triangle
—— *p s* the supplement of the angle T }
—— *p t* ——————— S } given,
The angle *s* ——————— side T P }

and

and by Case III. find the side *t s*, the supplement of P, the angle sought.

Afterwards find, according to Case I.

The angle *t* the supplement of the side P S } sought.
——— *p* ——————— side P T }

Table for the Correction of the Sun and Moon.

The correction is supposed to be 39 m. 42 s. Take in the column of minutes and seconds 39; by the side of which is 6° 33′, and by the side of 42′ is 7′. Therefore ten times the correction of 39′ 42″ is 6° 37′.

Minutes or Seconds of Correction.	Degrees and Minutes, or Minutes and Seconds.		Minutes or Seconds of Corrections.	Degrees and Minutes, or Minutes and Seconds.	
10	1	40	36	6	—
11	1	50	37	6	10
12	2	—	38	6	20
13	2	10	39	6	30
14	2	20	40	6	40
15	2	30	41	6	50
16	2	40	42	7	—
17	2	50	43	7	10
18	3	—	44	7	20
19	3	10	45	7	30
20	3	20	46	7	40
21	3	30	47	7	50
22	3	40	48	8	—
23	3	50	49	8	10
24	4	—	50	8	20
25	4	10	51	8	30
26	4	20	52	8	40
27	4	30	53	8	50
28	4	40	54	9	—
29	4	50	55	9	10
30	5	—	56	9	20
31	5	10	57	9	30
32	5	20	58	9	40
33	5	30	59	9	50
34	5	40	60	10	—
35	5	50			

Memoir on the Motions which certain Fluids receive by the Contact of other Fluids. By J. DRAPARNAND, *Professor of Natural History at the Ecole de Medeune at Montpellier.*

From the ANNALES DE CHIMIE.

I HAD observed that alcohol attacks, and in the course of time even destroys, the calcareous covering of the mollusca which are put into it in order to be preserved. Suspecting that this might arise from the circumstance that the alcohol, especially when it is not well rectified, contained a little acetous acid, I put into a glass capsule a small quantity of tincture of turnsole, and poured upon it some drops of alcohol. The colour of the tincture was not changed; but, to my very great surprise, it receded towards the circumference with great vivacity, leaving the bottom of the capsule exposed: when it had arrived at the maximum of recession it returned again, and anew covered the bottom of the vessel which it had quitted. Thus not finding what I sought, I discovered what I had not looked for, a circumstance which frequently happens in the routine of experiments.

This curious experiment induced me to make many others, and to try a great number of substances. At the moment when I was engaged in arranging these experiments, and composing this memoir from them, I recollected to have read that M. Benedict Prevost had produced this repulsion of water by means of the volatile oils, and even by many odorous solid bodies. I therefore consulted the two memoirs which this ingenious philosopher has inserted in the "Annales de Chimie," and which have for their object, *The means of rendering the emanations of odorous bodies sensible to the eye.* (See Annales

Annales de Chimie, Tom. XXI and XXIV.) Though my experiments were made with a different view, I shall pass over in silence all those which coincide with those of M. Prevost, and which I made by employing the same substances; I shall speak only of those which differ from them, either by the results obtained or by the means employed.

I. If we put a thin layer of water upon the bottom of a vessel, and with a glass rod convey a drop of alcohol to the centre of this layer, the water immediately recedes with vivacity, and leaves the bottom of the vessel exposed; when it has arrived at the maximum of recession, it flows back, and again covers the bottom of the vessel which it had abandoned.

II. The *disk of recession* I term that part of the bottom of the vessel which is abandoned by the water. This disk presents in the preceding experiment a perfect dryness, and all its natural polish.

III. In proportion as we repeat the experiment in the same water, the repulsion is less considerable, and the disk of recession is smaller. This proceeds from the circumstance that the water gradually becomes saturated with alcohol.

IV. The nature of the vessels has no influence upon the preceding experiment, nor upon those which follow. They take place equally in vessels of porcelain, of Delft-ware, or of metal.

V. The form of the vessels has much influence upon the second period of the phenomenon, that is to say, upon the reflux of the water, and the disappearing of the disk of recession.

If the vessel is a little concave, the water always returns, and again covers the bottom of the vessel. It is evident that this is a necessary effect of its gravity.

If the bottom of the vessel is a little convex, the water does not return after having receded, and it is plain that to do this it would be necessary that it should act contrary to the operation of its own gravity.

VI. Wishing to render the observation of the motions of the repelled fluid more easy and perfect, I substituted in place of the pure water, which was employed in the preceding experiment, the tincture of turnsole, which, it is well known, is only water coloured with cake-turnsole. The results were the same, but much more sensible, and I then very plainly distinguished an undulatory or tremulous motion at the inner margin of the water which surrounds the disk of recession; a motion which proves a continual emission of alcoholic particles against this inner margin, which determines the recession of the water.

VII. But, in order to complete the proof of the explanation which I have just given of this phenomenon, it was necessary to render sensible the motions also of the motor fluid, which I accomplished by an analogous process. I coloured the alcohol by means of cake-turnsole: with this substance it assumes a very fine colour, which by no means resembles the violet-blue of the tincture of turnsole, but which, on the contrary, is of a very lively blue cast, analogous to that of indigo or Prussian blue. I therefore moistened the bottom of a plate with pure water, and conveyed to the centre, with a glass rod, a drop of this coloured alcohol; the recession of the water took place with vivacity. At the centre of the disk of recession there was a blue spot formed by the coloured alcohol, and the rest of the disk was white, like the bottom of the plate. But what proves that there was really a continual emission of coloured alcoholic particles, is that in proportion as the water receded, its internal margin, which

which touches the disk of recession, became more and more of a violet colour, analogous to that of the tincture of turnsole prepared with water. Thus we see that in physics, facts are explained by facts, and that this experiment confirms the inference which I had drawn from the preceding experiments.

VIII. If we moisten the plate with alcohol, and place in the centre a drop of water, the alcohol experiences no motion, the drop of water becomes flattened, it preserves for some moments its circular form, and at length extending itself irregularly mixes and unites with the alcohol.

IX. If we cover the bottom of the plate with a very thin layer of olive oil, and place upon the centre a drop of alcohol, the oil is repelled, though more slowly than the water, on account of its viscosity, and the bottom of the plate is laid bare.

If the layer of oil were too thick, it would not abandon the bottom of the plate, and the motion of the expansion of the oil would take place only at the surface of the oil.

X. If we place upon the centre of a wet plate a piece of fresh lemon or orange peel, the water is sensibly repelled, and the disk of recession is agreeably radiated, which depends upon the disengagement of the essential oil. But this motion is not by far so intense as that which is produced by means of alcohol.

XI. Convinced by the preceding experiments that every fluid volatile at the temperature of the atmosphere, was capable of producing this motion of repulsion, I employed liquid ammoniac. I therefore wetted the plate in the ordinary manner, and placed upon the centre a drop of volatile alkali. What was my surprise to see, that not the slightest motion manifested itself in the water; I however

however suspected the cause, and imagined that this apparent anomaly was owing to the circumstance that the ammoniac, which has a very great affinity with water, combines with it immediately at the moment of contact.

XII. I therefore resolved to substitute in place of water a fluid which had less affinity with ammoniac, and I chose olive oil, which I had at hand. I covered the bottom of the plate with a slight layer of this oil, and placed upon the centre a drop of ammoniac. The oil was immediately repelled as it is by alcohol.

XIII. If we wet the plate with alcohol, and place upon the centre a drop of ammoniac, the alcohol is not repelled, the drop of ammoniac is flattened, and both liquors evaporate. I imagined I perceived a slight tremulous motion at the sides of the drop of ammoniac.

XIV. If we wet the plate with ammoniac, and place upon the centre a drop of alcohol, the ammoniac is repelled as pure water would be. It therefore appears, according to this and the preceding experiments, that the horizontal or lateral force of expansion is greater in alcohol than in ammoniac.

XV. A drop of olive oil put upon a wet plate did not produce any motion in the water. The case is the same with oil beat up with water to the consistence of an ointment. M. Prevost seems to announce, in his Memoirs, results which would be contradictory to my experiments, and especially to the latter.

I shall not dilate farther upon experiments which some persons may perhaps consider to be more curious than useful. However, when the attractive powers of yellow amber, or of the loadstone, were first observed, their importance, and the astonishing discoveries to which they have since led, were never suspected.

On

On the alloying Gold with Platina.

From the ANNALES DE CHIMIE.

M. GUYTON has communicated to the Society for the Encouragement of National Industry, some experiments upon the alloying of gold and platina, which they have inserted in their bulletin of Prairial last.

The object of these experiments was to determine to what degree platina might serve the purposes of imposition, in the fabrication of counterfeit pieces of gold.

For this purpose, it was necessary to arrive at such proportions, that the alloy should be at the same degree of specific weight with the gold issued from the mint, which is that of 17, 64; and that, nevertheless, the quantity of gold should be sufficiently reduced to afford some profit to the coiners.

The condition of attaining the specific weight, or the same volume for an equal weight, does not permit the standard to be lowered beyond 0,700; otherwise the excess of weight would betray the fraud, even without its being necessary to have recourse to the instrument of M. Vincent.

But what presents a still greater obstacle, not only to a greater lowering of the standard, but also to the counterfeiting of gold coins by the alloy of platina in general, is the very sensible alteration which the last metal produces in its colour.

The button of alloy which M. Guyton submitted to the inspection of the Society, contained only 0,155 of platina, and yet the alteration of colour was already so considerable, that even the palest gold colour could not be recog-

recognized in it. M. Guyton also remarked, that he had employed only copper in this composition, so that the colour was as well preserved as it could be in those proportions, whereas, it would have been much more weakened if silver had entered into the alloy *.

Thus we are able to appreciate the apprehensions which have been so much exaggerated, of the abuse which may be made of platina alloyed, that is to say, fused with gold. As to platina covered with gold-leaf, the excess of specific weight, which is more than 19, soon causes it to be suspected; and if we have any doubts, it will be sufficient to let a drop of nitro-muriatic acid fall upon the piece, which exposes the grey colour.

The article is concluded with this reflection, taken from the report delivered to the institute, by M. Guyton, upon the instrument of M. Vincent: "In proportion as the fabricators of base coin apply themselves to "the improvement of this pernicious art, we also find "the means of detecting its products."

* According to the observation of Mr. Klaproth, in the alloys of gold and platina, the colour of the gold is predominant only in the proportion of eight to one. *Annales des Arts et Manufactures*, &c. Tom. XII. p. 237.

In a work which Mr. Hatchett, fellow of the Royal Society of London, has lately published on the alloys of gold, &c. the translation of which into French, by M. Lerat, Comptroller of the Mint at Paris, is already in the press, we find a new proof of this fact. This chemist having formed an alloy of 442 grains of gold, and 38 of platina, into which consequently the latter metal did not enter into quite as large a proportion as that of 0,080, it had only a yellowish blue colour, resembling that of tarnished silver.

Intelligence

Intelligence relating to Arts, Manufactures, &c.

(Authentic Communications for this Department of our Work will be thankfully received.)

Edinburgh Highland Society.

THE Highland Society of Scotland have offered the following premiums for Essays, for the year 1804.

1st. A piece of plate, of the value of sixty pounds sterling, will be given for the best and approved essay,

"Upon the properties and uses of peat moss, first, as "soil, and, secondly, on the best methods of converting "it into manure, illustrated by actual and authenticated "experiments."

2d. A piece of plate, of the value of thirty guineas, will be given for the best and approved essay, "On the "most proper season and the best methods of gathering, "siving, and ascertaining the qualities of rye-grass and "clover-seeds, and on the profits which may be expected "from crops of rye-grass, or clovers, raised chiefly with "a view to saving the seeds."

N. B. This being a subject of very great importance to the agriculture of the kingdom, the society will not adjudge the premium offered for the communication upon it until 20th Nov. 1805; and, on the other hand, it is expected, that the competitors will rest their statements on experiments, made at various periods of summer, on at least an ½ acre of extent each.

3d. A gold medal or piece of plate, of twenty guineas value, will be given to the person who shall on or before the 20th November, 1805, lodge with the deputy secretary the best and approved essay,

"Concerning such of our native plants, particularly "the grasses, as are most deserving of culture, with the "view of affording herbage for pasture or hay, distin-"guishing the climate and soil respectively adapted for "them, and the time and manner of collecting and sow-"ing their seeds, or of otherwise propagating them, "taking notice of the different species which are parti-"cularly preferred by cattle, horses, and sheep."

The premium for this essay is to be given under the following conditions: the number of the species of which an account is to be given, must not be under five, nor above fifteen; and fresh or dried specimens of the several plants, with a small portion of the seed of each, are to be delivered along with the essay to the secretary.

4th. A piece of plate, of fiteen guineas value, will be given for the best and approved essay, as an answer to the following questions:

"How far do frosts and considerable degrees of cold "retard, or totally prevent the farther filling and ripen-"ing of corn, particularly oats? And in what stages of "vegetation or approaching ripeness are the worst effects "to be apprehended? What are the stages of growth "and ripeness? And what are the peculiar stages of the "weather, and other circumstances, in which corn, "particularly oats, are rendered unfit for seed? And "to what degree, and by what appearances, can the "point of distinction between the good and bad seed "be readily ascertained?"

N. B. The society is desirous of receiving the most accurate answers to these queries respecting the corn; and it is therefore expected, that, when the author draws inferences, they are to be supported by practical facts, or correct and well authenticated experiments, on such a scale as may warrant a general conclusion.

5th.

5th. A piece of plate, of fifty guineas value, will be given for the best and approved essay,

"On the accidents and disorders to which sheep are "liable, and particularly on those destructive diseases "to which, in many situations and seasons, they are in- "cident, called in different parts of Scotland, the one "by the name of Braxy or Braxit, or the sickness; and "the other by that of rot or the poke. &c. on the va- "rieties or different kinds of these disorders, the causes "inducing them, and the means of preventing or re- "moving them in the different cases."

As there is reason to apprehend, that disorders of different sorts are included under each of these two general names, the society wish that a description shall be given of the appearances which occur in opening the body of animals, afflicted with any of these distempers.

6th. A piece of plate, of twenty-five guineas value, will be given for the best and approved essay,

"On a good and cheap method of making from rock- "salt, salt-springs, or from sea-water, a pure salt, at "least, equal to the refined salt used by the Dutch for "curing fish."

7th. A piece of plate, of twenty guineas value, will be given for the best and approved essay,

"On an effectual and cheap method of purifying the "salt made according to the present processes, whether "foreign or British, so as to render it equal to the Dutch "fishery salt."

N. B. In case any person chuses to combine the objects of the two preceding premiums, and his essay is preferred, as exhausting both subjects, he shall be entitled to both premiums.

The essay or essays on (both) these subjects, to be accompanied with accurate descriptions or drawings of

 the

the buildings, machinery, or utensils proposed to be used, and an estimate of the probable expense of the manufacture, compared with that of making salt now in use.

8th. A piece of plate, of ten guineas value, will be given for the best and approved essay,

"Shewing what plants, fit for making hedges, thrive "best in high and exposed, and also in maritime situa-"tions or poor soils; and what are the best methods of "training these as hedges for inclosures."

9th. A piece of plate, of fifteen guineas value, will be given for the best and approved essay,

"On the nature, cause, and prevention of that ap-"pearance which has been so general on, and hurtful to "the larix throughout Scotland."

Rules of Competition.

In all these essays, it is expected, that when facts not generally known are stated, they will be authenticated by proper references; and also, that the essays will be written in a fair and legible hand. The society would likewise recommend, that one page of the folio may be left blank, for any observations that may occur to members of the society, on perusal.

The essays on all the above subjects (excepting Nos. 2d and 3d) to be lodged with the deputy-secretary of this society, on or before the 20th November, 1804, at farthest. The essays on subjects 2d and 3d, on or before the 20th November, 1805, as above stated. Each essay must be inscribed with some distinguishing motto or device.

A sealed note, containing the author's name, and inscribed on the back with the motto or device of his essay, must

must be lodged at the same time with the essay, and when the motto or device on the essay or sealed note is neglected by the author, such essay will not be allowed to compete for any premium.

N. B. None of the sealed notes, except those which bear the distinguishing motto or device of preferred essays will be opened; and the society are to be at liberty to publish the essay for which premiums shall be adjudged, or such part of them as they shall think proper to be communicated to the public; and such essays as are not found entitled to any premium, will be returned to the author when called for. Farther, upon application from the gainer of any of these premiums, the society, in such cases as they may see proper, will allow them to be paid in money.

A cheap and lasting Paint for Gates, Rails, and Palasades.

Skimmed milk - - - - - -	2 quarts.
Fresh slaked lime - - - -	8 ounces.
Boiled linseed oil - - - -	6 ounces.
White Burgundy pitch - -	2 ounces.
Spanish white - - - - -	3 pounds.

Slake the lime by dipping it in water, and then expose it to the air till it falls into powder. Then mix it with the fourth-part of the milk, adding the oil, a little at a time. Stir it well with a wooden spatula, adding the remainder of the milk. Lastly, add the Spanish white. The pitch must be previously dissolved in the oil by a gentle heat. When used, to be laid on (two coats) with a painter's brush. The expense about a half-penny a square yard.

List

List of Patents for Inventions, &c.

(Continued from Vol. IV. Page 472.)

JOSIAH CRANE and RICHARD MARCH, of Barnstaple, in the county of Devon, Hosiers; for a method of double seaming and uniting the insides of stocking net-work together, so as to consolidate and make it one compact and elastic body, for cutting into any shape required, and converting into all or any of the articles in hosiery, or other garments or wearing apparel, to be worn double. Dated May 1, 1804.

NATHANIEL MERRIMAN, of Crutched Friars, in the city of London, Tin-manufacturer; for a stove, grate or range, upon an improved construction; the improved construction of which is likewise applicable to those already in use, for the purpose of clearing away foul air from churches, chapels, and all other places of public resort, as well as houses, buildings, and rooms of every description. Dated May 8, 1804.

JOHN SWIFT SAXELBYE, of the town of Derby, in the county of Derby, White-lead-maker; for a method of making white-lead different from the methods now practised or used, and without the aid of horse-litter or tanners bark, or either of them. Dated May 14, 1804.

JOSEPH MOSELEY ELLIOTT, of the Parish of St. Mary-le-bone, in the county of Middlesex, Watch-maker; for a method of making repeaters, or repeating watches, and chronometers. Dated May 14, 1804.

ROBERT BROWN, of the town and county of the town of Nottingham, Lace-manufacturer; for a machine to affix or attach to horizontal warp or Vandyke knitting-frames,

frames, for the purpose of manufacturing, by a more simple, neat and expeditious method, lace or net-work of various figures and qualities, with thread, silk, cotton, worsted, or other materials produced from animal, vegetable or mineral substances. Dated May 14, 1804.

THOMAS DOBBS, of King's Norton, in the county of Worcester, Chemist; for a new article of trade which he denominates *Albion Metal*, and which he applies to the making of cisterns, linings for cisterns, covering and gutters for buildings, boilers, vats, coffin-furniture, worms for distillers, and such other things as require to be made of a flexible, a wholesome, or a cheap metallic substance. Dated May 14, 1804.

JOSHUA JOWETT, of High Holborn, in the county of Middlesex, Ironmonger; for a fire-guard stove. Dated May 18, 1804.

JOHN PETER BARTHELEMY, of Marshall-street, in the county of Middlesex, Stay-maker, and JAMES STROUBRIDGE, of Old Bond-street, in the parish of St. George, Hanover-square, in the said county of Middlesex, Hatter; for a shield or protection for the preservation of the human body against sword, bayonet or pike, as also being proof against a musket-ball at a moderate distance. Dated May 18, 1804.

JOSEPH BURRELL, of Thetford, in the county of Norfolk, Iron-founder; for an improved threshing machine. Dated May 18, 1804.

FREDERICK ALBERT WINSOR, of Cheapside, London, Merchant; for an improved oven, stove, or apparatus, for the purpose of extracting inflammable air, oil, pitch, tar and acids, and reducing into coke and charcoal all kinds of fuel, and which is also applicable to various other useful purposes. Dated May 18, 1804.

GEORGE

George Simmonds, of ————; for a method of manufacturing hats, bonnets, and other useful articles of paper. Dated May 19, 1804.

Samuel Godwin, of Avoncliffe, near Bradford, in the county of Wilts, Clothier; for improvements upon machines for carding, scribling, dressing, and brushing, wool and woollen cloth. Dated May 30, 1804.

Samuel Lucas, of Sheffield, in the county of York, Refiner; for a method of separating the impurities from crude or cast iron without fusing or melting it, and of rendering the same malleable, and proper for the several purposes for which forged or rolled iron is now used; and also by the same method of improving articles manufactured of cast-iron, and thereby rendering cast or crude iron applicable to a variety of new and useful purposes. Dated May 30, 1804.

John Porter, of Lemonville, near Tandragee, in the county of Armagh, in that part of the United Kingdom called Ireland, Gentleman; for a lamp upon a new construction. Dated May 30, 1804.

John Duncan, of Glasgow, Manufacturer; for an improved method or means of tambouring, or raising of flowers, figures, or other ornaments, upon muslins, lawns, and other cottons, cloths or stuffs, or upon silk, linen or woollen cloths or stuffs, or upon cloths or stuffs composed partly of silk, cotton or woollen.
Dated May 30, 1804.